Operating Instructions

VEGAPULS 61

4 … 20 mA/HART

Radar

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Supplementary operating instructions manuals

Information:
VEGAPULS 61 is available in many versions and is therefore supplied according to customer order. Depending on the selected version, supplementary operating instructions manuals also come with the delivery. You will find the supplementary operating instructions manuals in chapter "*Product description*".

Operating instructions manuals for accessories and replacement parts

Tip:
To ensure reliable setup and operation of your VEGAPULS 61, we offer accessories and replacement parts. The associated documents are:

- Operating instructions manual 30176 "*External indicating and adjustment unit VEGADIS 61*"
- Operating instructions manual 27720 "*Oscillator VEGAPULS series 60*"

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1 About this document

1.1 Function

This operating instructions manual provides all the information you need for mounting, connection and setup. In addition, you will find important notes on maintenance and trouble shooting. Please read this information before putting the instrument into operation.

Keep this manual as a product component safe and accessible in the immediate proximity of the device.

1.2 Target group

This operating instructions manual is directed to trained, qualified personnel. The contents of this manual should be made available to these personnel and put into practice by them.

1.3 Symbolism used

Information, tip, note
This symbol indicates helpful additional information.

Caution: If this warning is ignored, faults or malfunctions can result.
Warning: If this warning is ignored, injury to persons and/or serious damage to the instrument can result.
Danger: If this warning is ignored, serious injury to persons and/or destruction of the instrument can result.

Ex applications
This symbol indicates special instructions for Ex applications.

- **List**
  The dot set in front indicates a list with no implied sequence.

→ **Action**
This arrow indicates a single action.

1 **Sequence**
Numbers set in front indicate successive steps in a procedure.

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2 For your safety

2.1 Authorised personnel

All operations described in this operating instructions manual must be carried out only by trained specialist personnel authorised by the operator.

During work on and with the device the required personal protection equipment must always be worn.

2.2 Appropriate use

VEGAPULS 61 is a sensor for continuous level measurement.

You can find detailed information on the application range of VEGAPULS 61 in chapter "*Product description*".

2.3 Warning about misuse

Inappropriate or incorrect use of the instrument can give rise to application-specific hazards, e.g. vessel overfill or damage to system components through incorrect mounting or adjustment.

2.4 General safety instructions

VEGAPULS 61 is a high-tech instrument requiring the strict observance of standard regulations and guidelines. The emitting frequencies of all radar sensors are in the C or K-band range (depending on the instrument version). The low transmitting power is far below the internationally permitted limit values, and when the instrument is used correctly, no health-endangering effects are to be expected. There are no restrictions on using the instrument on the outside of metallic, closed vessels.The user must take note of the safety instructions in this operating instructions manual, the country-specific installation standards (e.g. the VDE regulations in Germany) as well as all prevailing safety regulations and accident prevention rules.

2.5 CE conformity

VEGAPULS 61 is in CE conformity with EMVG (89/336/EWG), R & TTE directive (1999/5/EC) and LVD (73/23/EWG).[1)]

[1)] R & TTE-Richtlinie (1999/5/EC): Not with version with increased sensitivity.

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CE conformity has been judged according to the following standards:

- EMC: EN 61326: 2004
  - Emission: Class B
  - Susceptibility: Industrial areas
- R & TTE directive: I-ETS 300-440 Expert opinion No. 0043052-02/SEE, Notified Body No. 0499
- LVD: EN 61010-1: 2002

2.6 Fulfilling NAMUR recommendations

With regard to interference resistance and interference emission, VEGAPULS 61 fulfils NAMUR recommendation NE 21.

VEGAPULS 61 and its indicating and adjustment components fulfill NAMUR recommendation NE 53 in respect to compatibility. VEGA instruments are generally upward and downward compatible:

- Sensor software to DTM VEGAPULS 61 HART, PA or FF
- DTM VEGAPULS 61 for adjustment software PACTware™
- Indicating and adjustment module for sensor software

The parameter adjustment of the basic sensor functions is independent of the software version. The range of available functions depends on the respective software version of the individual components.

The software version of VEGAPULS 61 can be determined as follows:

- via PACTware™
- on the type label of the electronics
- via the indicating and adjustment module

You can view all software histories on our website www.vega.com. Make use of this advantage and get registered for update information via e-mail.

2.7 SIL conformity

VEGAPULS 61 fulfills the requirements for functional safety according to IEC 61508/IEC 61511. You can find further information in the Safety Manual "*VEGAPULS series 60 - 4 … 20 mA/HART*".

2.8 FCC/IC conformity (only for USA/Canada)

VEGAPULS sensors with all antenna versions are FCC/IC approved.

Modifications not expressly approved by VEGA will lead to expiry of the operating licence according to FCC/IC.

VEGAPULS 61 is in conformity with part 15 of the FCC directives and fulfills the RSS-210 regulations. Note the corresponding regulations for operation:

- The instrument must not cause any interfering emissions
- The instrument must be insensitive to interfering emissions, also to such that may cause unwanted operating conditions.

The instrument is designed for operation with an antenna according to the "*Dimensions*" in the "*Supplement*" of this operating instructions manual, with a max. amplification of 33 dB. The instrument must not be operated with antennas not listed therein or those having an amplification of more than 33 dB. The required antenna impedance is 50 Ohm.

2.9 Safety instructions for Ex areas

Please note the Ex-specific safety information for installation and operation in Ex areas. These safety instructions are part of the operating instructions manual and come with the Ex-approved instruments.

2.10 Manufacturer declaration

In conformity with DIN EN 60079-14/2004, para. 5.2.3, point c1, VEGAPULS 61 is suitable for use in zone 2.

The operator must use the instrument as it was intended to be used and follow the specifications of the following documents:

- this operating instructions manual
- this manufacturer declaration (24626)
- the applicable installation regulations

Max. increase of the surface temperature during operation: 27 K (individual components in the instrument)

With an ambient temperature of 70 °C (158 °F) on the housing and a process temperature of 70 °C (158 °F), the max. ambient temperature during operation is 97 °C (207 °F).

Measures to maintain explosion protection during operation:

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- Operate the instrument in the range of the specified electrical limit values. Permissible supply voltage: see "*Technical data*"
- Mount and operate the instrument in such a way that no danger of ignition from electrostatic charges is to be expected. The antenna, the process fitting or the housing (as the case may be depending on instrument version) are made of electrically non-conductive plastic.
- Make sure that the seal is mounted correctly between lower part of the housing and cover. Screw the cover on tightly.
- Make sure there is no explosive atmosphere present if you intend to operate the instrument with opened cover
- Make sure that the cable gland is tight and strain-relieved. The outer diameter of the connection cable must be adapted to the cable gland. Tighten the pressure screw of the cable gland carefully.
- Cover unused openings for cable glands tightly
- Mount the instrument in such a way that the sensor cannot touch the vessel wall or vessel installations. Keep in mind the influence of product movement in the vessel.
- The surface temperature of the housing must not exceed the ignition temperature of the surrounding explosive atmosphere

This instrument was assessed by a person who fulfils the DIN EN 60079-14 requirements.

2.11 Functional range of approved instruments

Instruments with specific approvals are partly supplied with an earlier hardware or software version. For approval-technical reasons, some functions for these instruments will be available only at a later date.

You will find corresponding instructions in the description of the individual functions in this operating instructions manual.

2.12 Environmental instructions

Protection of the environment is one of our most important duties. That is why we have introduced an environment management system with the goal of continuously improving company environmental protection. The environment management system is certified according to DIN EN ISO 14001.

Please help us fulfil this obligation by observing the environmental instructions in this manual:

- Chapter "*Packaging, transport and storage*"
- Chapter "*Disposal*"

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3 Product description

3.1 Configuration

Versions

The VEGAPULS 61 radar sensor is available in two electronics versions:

- Standard electronics type PS60**KH**
- Electronics with increased sensitivity type PS60**KD**

The respective version can be determined by means of the type label on the electronics.

The electronics version influences the CE conformity, the functional safety (SIL), the factory setting for product selection and vessel form, the accuracy, the voltage supply as well as the approvals of VEGAPULS 61. The differences are specified in this operating instructions manual in the respective paragraphs.

Scope of delivery

The scope of delivery encompasses:

- VEGAPULS 61 radar sensor
- Mounting strap (option)
- Compression or adapter flange (optional)
- Documentation
  - this operating instructions manual
  - Supplementary instructions manual "*Safety Manual according to IEC 61508/IEC 61511 (SIL)*"
  - Operating instructions manual "*Indicating and adjustment module*" (optional)
  - Supplementary instructions manual "*Heating for indicating and adjustment module*" (optional)
  - Supplementary instructions manual "*Plug connector for continuously measuring sensors*" (optional)
  - Ex-specific "*Safety instructions*" (with Ex-versions)
  - if necessary, further certificates

Components

VEGAPULS 61 consists of the following components:

- Process fitting with encapsulated antenna system or plastic horn antenna
- Housing with electronics, optionally available with plug connector, optionally available with connection cable
- Housing cover, optionally available with indicating and adjustment module

The components are available in different versions.

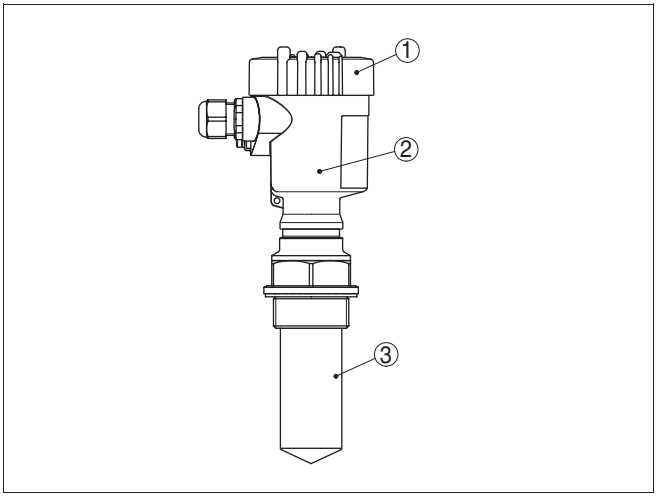

Fig. 1: VEGAPULS 61, threaded version with encapsulated antenna system and plastic housing
1 Housing cover with integrated PLICSCOM (optional)
2 Housing with electronics
3 Process fitting with encapsulated antenna system

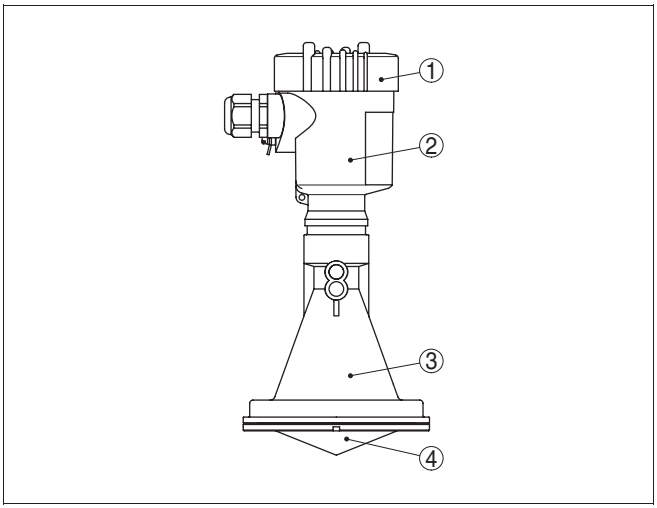

Fig. 2: VEGAPULS 61, version with plastic horn antenna and plastic housing
1 Housing cover with integrated PLICSCOM (optional)
2 Housing with electronics
3 Process fitting with plastic horn antenna
4 Focussing lens

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3.2 Principle of operation

Area of application

VEGAPULS 61 is a radar sensor in K-band (emitting frequency approx. 26 GHz) for continuous level measurement.

The version with **encapsulated antenna system** is particularly suitable for level measurement of aggressive liquids in small vessels.

The version with **plastic horn antenna** is particularly suitable for flow measurement in open flumes or gauge measurement in waters.

The electronics version "**Increased sensitivity**" enables the use of VEGAPULS 61 also in applications with very bad reflective properties or products with low e_r value.

Functional principle

The antenna of the radar sensor emits short radar pulses with a duration of approx. 1 ns. These pulses are reflected by the product and received by the antenna as echoes. The running time of the radar pulses from emission to reception is proportional to the distance and hence to the level. The determined level is converted into an appropriate output signal and outputted as measured value.

Supply

Two-wire electronics 4 … 20 mA/HART for power supply and measured value transmission over the same cable.

The supply voltage range can differ depending on the instrument version.

The data for power supply are stated in chapter "*Technical data*" in the "*Supplement*".

The backlight of the indicating and adjustment module is powered by the sensor. The prerequisite for this is a supply voltage at a certain level. The exact voltage specifications are stated in chapter "*Technical data*" in the "*Supplement*".

This function is available for instruments with national approvals such as e.g. according to CSA only at a later date.

The optional heating requires its own power supply. You can find detailed information in the supplementary instructions manual "*Heating for indicating and adjustment module*". This function is generally not available for approved instruments.

3.3 Operation

VEGAPULS 61 can be adjusted with different adjustment media:

- with indicating and adjustment module
- with the suitable VEGA DTM in conjunction with an adjustment software according to the FDT/DTM standard, e.g. PACTware™ and PC
- with manufacturer-specific adjustment programs AMS™ or PDM
- with a HART handheld

The entered parameters are generally saved in VEGAPULS 61, optionally also in the indicating and adjustment module or in PACTware™.

3.4 Packaging, transport and storage

Packaging

Your instrument was protected by packaging during transport. Its capacity to handle normal loads during transport is assured by a test according to DIN EN 24180.

The packaging of standard instruments consists of environment-friendly, recyclable cardboard. For special versions, PE foam or PE foil is also used. Dispose of the packaging material via specialised recycling companies.

Transport

Transport must be carried out under consideration of the notes on the transport packaging. Nonobservance of these instructions can cause damage to the device.

Transport inspection

The delivery must be checked for completeness and possible transit damage immediately at receipt. Ascertained transit damage or concealed defects must be appropriately dealt with.

Storage

Up to the time of installation the packaging must be closed and stored according to the orientation and storage markings on the outside.

Unless otherwise indicated, the packaging must be stored only under the following conditions:

- Not in the open
- Dry and dust free
- Not exposed to corrosive media
- Protected against solar radiation
- Avoiding mechanical shock and vibration

Storage and transport temperature

- Storage and transport temperature see "*Supplement - Technical data - Ambient conditions*"
- Relative humidity 20 … 85 %

4 Mounting

4.1 General instructions

Installation position

Select an installation position you can easily reach for mounting and connecting as well as later retrofitting of an indicating and adjustment module. The housing can be rotated by 330° without the use of any tools. You can also install the indicating and adjustment module in four different positions (each displaced by 90°).

Screwing in

Warning:
The housing of threaded versions must not be used to screw the instrument in! Applying tightening force on the housing can damage its rotational mechanical parts.

Moisture

Use the recommended cables (see chapter "*Connecting to power supply*") and tighten the cable gland.

You can give your VEGAPULS 61 additional protection against moisture penetration by leading the connection cable downward in front of the cable entry. Rain and condensation water can thus drain off. This applies mainly to mounting outdoors, in areas where moisture is expected (e.g. by cleaning processes) or on cooled or heated vessels.

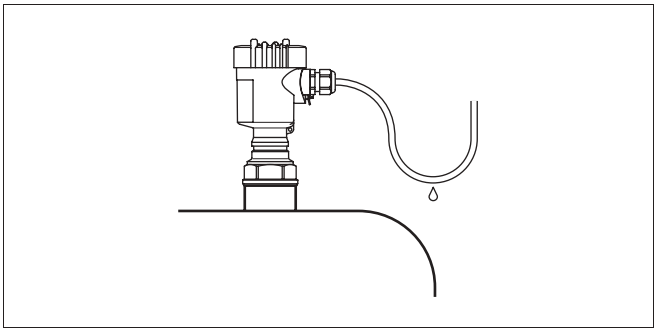

Fig. 3: Measures against moisture penetration

Measuring range

The reference plane for the measuring range of the sensor depends on the antenna version.

With **encapsulated antenna system**, the reference plane is the seal surface of the thread.

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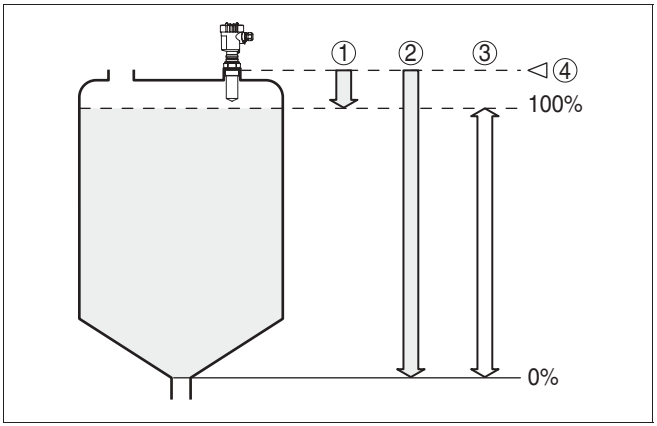


Fig. 4: Measuring range (operating range) and max. measuring distance with encapsulated antenna system
1 full
2 empty (max. measuring distance)
3 Measuring range

With **plastic horn antenna**, the bearing surface on the side of the focussing lense is the reference plane.

Information:
If the medium reaches the antenna, buildup can form on it and cause faulty measurements later on.

Wetted materials

Make sure that the wetted parts of VEGAPULS 61, especially the seal and process fitting, are suitable for the existing process conditions such as pressure, temperature etc. as well as the chemical properties of the medium.

You can find the specifications in chapter "*Technical data*" in the "*Supplement*".

4.2 Mounting preparations, mounting strap

The optionally available mounting strap is used to fasten VEGAPULS 61 on top of open vessels or flumes. It is suitable for mounting on walls, ceils or brackets. The strap is supplied unassembled and must be screwed to the sensor with the three hexagon screws M5x10 and spring washers before setup. Max. torque see chapter "*Technical data*". Necessary tools: Allen wrench size 4.

Two ways are possible for screwing on. Depending on the selected version, the sensors can be swivelled as follows in the strap:

- Single chamber housing
  - stepless by 180°
  - in three steps 0°, 90° and 180°
- Double chamber housing
  - stepless by 90°
  - in two steps 0° and 90°

4.3 Mounting instructions

Installation position

When mounting VEGAPULS 61, keep a distance of at least 200 mm (7.874 in) to the vessel wall. If the sensor is installed in the center of dished or round vessel tops, multiple echoes can arise. These can, however, be suppressed by an appropriate adjustment (see "*Setup*").

If you cannot keep this distance you should carry out a false echo memory before setup. This applies mainly if buildup is expected on the vessel wall. In this case, we recommend to repeat a false echo memory later with existing buildup.

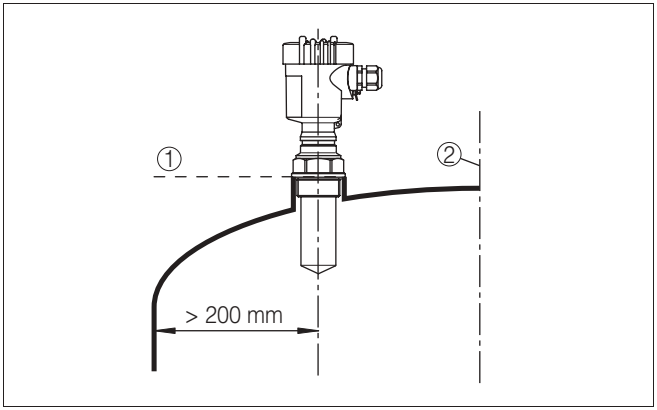


Fig. 5: Mounting on round vessel tops
1 Reference plane
2 Vessel center or symmetry axis

In vessels with conical bottom it can be advantageous to mount the sensor in the center of the vessel, as measurement is then possible down to the lowest point of the vessel bottom.

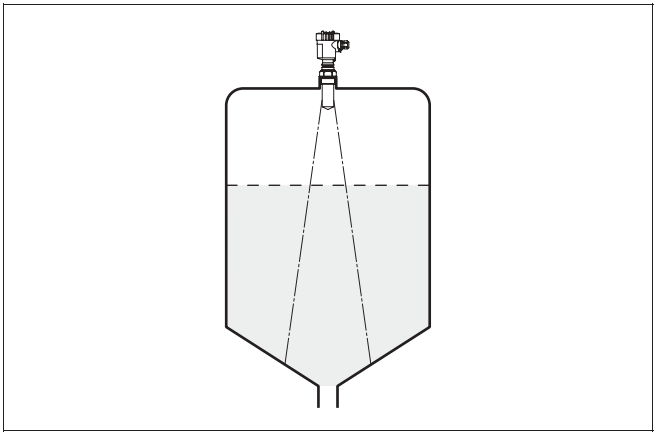


Fig. 6: Vessel with conical bottom

Inflowing medium

Do not mount the instruments in or above the filling stream. Make sure that you detect the product surface and not the inflowing product.

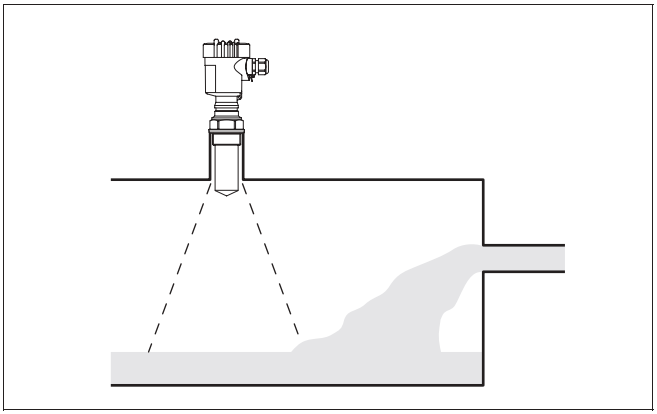


Fig. 7: Inflowing liquid

Socket

Socket pieces should be dimensioned such that the antenna end protrudes at least 10 mm (0.4 in) out of the socket.

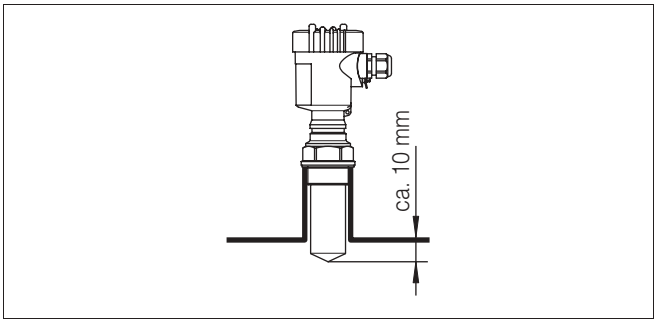
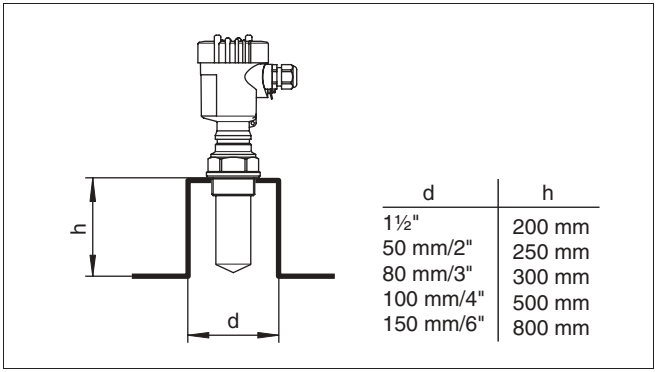


Fig. 8: Recommended socket mounting

If the reflective properties of the medium are good, you can mount VEGAPULS 61 on sockets which are higher than the length of the antenna. You will find recommended values for socket heights in the following illustration. The socket end should be smooth and burr-free, if possible also rounded. After installation you must carry out a false echo storage.



d	h
1½"	200 mm
50 mm/2"	250 mm
80 mm/3"	300 mm
100 mm/4"	500 mm
150 mm/6"	800 mm

Fig. 9: Deviating socket dimensions

Sensor orientation

Direct the sensor in liquids as perpendicular as possible to the product surface to achieve optimum measurement results.

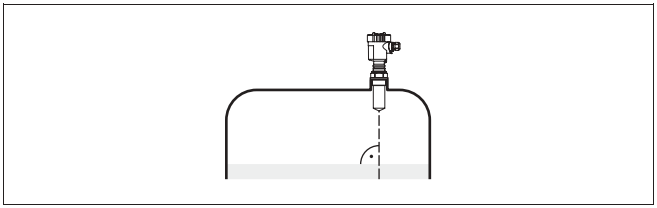


Fig. 10: Orientation in liquids

Vessel installations

The mounting location of the radar sensor should be a place where no other equipment or fixtures cross the path of the microwave signals.

Vessel installations such as, for example, ladders, limit switches, heating spirals, struts, etc. can cause false echoes that get superimposed on the useful echo. Make sure when planning your measuring site that the radar sensor has a "clear view" to the measured product.

In case of existing vessel installations, a false echo storage should be carried out during setup.

If large vessel installations such as struts or supports cause false echoes, these can be attenuated through supplementary measures. Small, inclined sheet metal baffles above the installations scatter the radar signals and prevent direct interfering reflections.

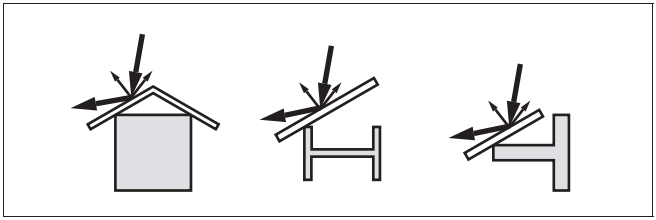


Fig. 11: Cover smooth profiles with deflectors

Agitators

If there are agitators in the vessel, a false echo storage should be carried out with the agitators in motion. This ensures that the interfering reflections from the agitators are saved with the blades in different positions.

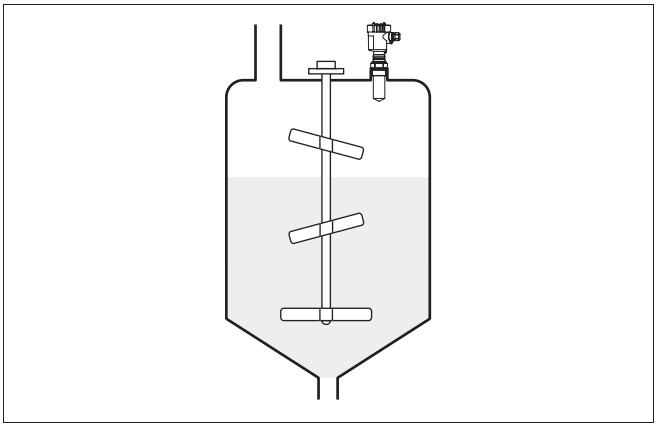


Fig. 12: Agitators

Foam generation

Through the action of filling, stirring and other processes in the vessel, dense foams which considerably damp the emitted signals may form on the product surface.

If foams lead to measurement errors, you should use the biggest possible radar antennas and low frequency radar sensors, e.g. VEGAPULS 65, 66 (C-band).

VEGAFLEX sensors with guided microwaves are not influenced by foam generation and are particularly suitable for such applications.

Measurement in the standpipe (surge or bypass tube)

By using a standpipe, the influence of vessel installations and turbulence can be excluded. Under these prerequisites, the measurement of products with low dielectric values (from DK value 1.6) is possible.

Note:
Measurement in a standpipe is not recommended for very adhesive products.

Surge or bypass tubes must extend all the way down to the requested min. level, as measurement is only possible within the tube.

Surge pipe
Make sure you provide the necessary upper vent hole in the surge pipe. The hole must be aligned so that it and the polarisation marking on the sensor are in the same plane (see illustration: "*Pipe antenna system in a tank*").

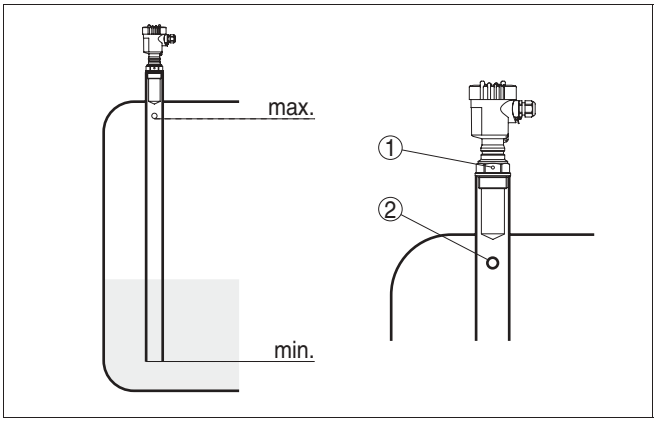


Fig. 13: Pipe antenna system in a tank. The vent hole in the surge pipe must be in one plane with the polarisation marking on the sensor.
1 Marking of the polarisation direction
2 Vent holde max. ø 5 mm (0.2 in)

If possible, the antenna diameter of the sensor should correspond to the inner diameter of the tube. With VEGAPULS 61 this is approx. 40 mm (1.575 in). The sensor can be used with tube diameters between 40 … 80 mm (1.575 … 3.15 in).

Bypass tube
As an alternative to the surge pipe in the vessel, a pipe system can be mounted outside of the vessel as a bypass tube. For setup, select the function "*Bypass tube*".

Align the sensor in such a way that the polarisation marking on the process fitting is in the same plane as the tube holes or the tube connection openings (see illustration: "*VEGAPULS in a bypass tube*").

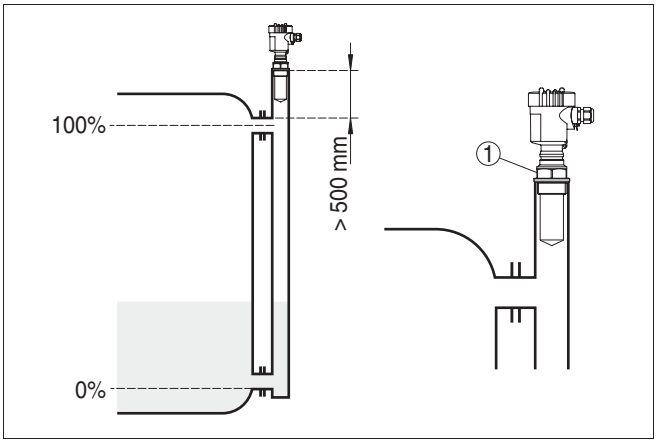


Fig. 14: VEGAPULS 61 in a bypass tube. The polarisation marking on the process fitting must be in one plane to the tube holes or the tube connection openings.
1 Marking of the polarisation direction

When the sensor is mounted on a bypass tube, the distance from VEGAPULS 61 to the upper tube connection should be approx. 500 mm (19.685 in) or more. In case of extremely rough tube inner walls, you should use an inserted tube (tube in tube) or a radar sensor with tube antenna.

Flow measurement

The short examples should just give introductory information for the flow measurement. Planning information is available from the flume manufacturers and in special literature.

Meas. wall with rectangular flume

In general, the following points must be observed:

- Installation of the sensor on the headwater side
- Installation in the center of the flume and vertical to the liquid surface
- Distance to the overfall orifice
- Distance orifice opening above ground
- Min. distance of the orifice opening to bottom water
- Min. distance of the sensor to max. storage level

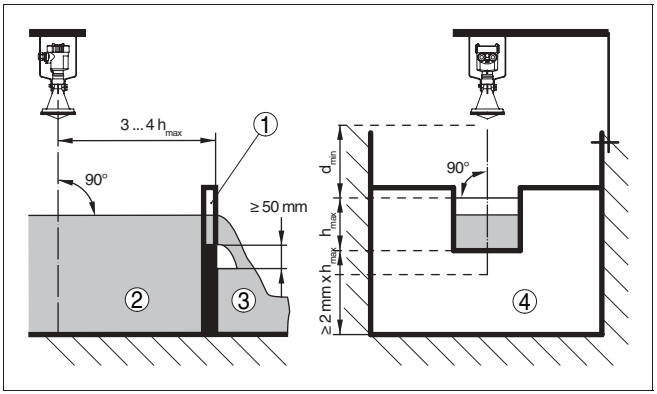


Fig. 15: Flow measurement with rectangular flume: d = min. distance of the sensor; hmax. = max. filling of the rectangular flume

1 Overfall orifice (side view)
2 Headwater
3 Bottom water
4 Overfall orifice (view from bottom water)

Khafagi-Venturi flume

In general, the following points must be observed:

- Installation of the sensor at the inlet side
- Installation in the center of the flume and vertical to the liquid surface
- Distance to the Venturi flume
- Min. distance of the sensor to max. storage level

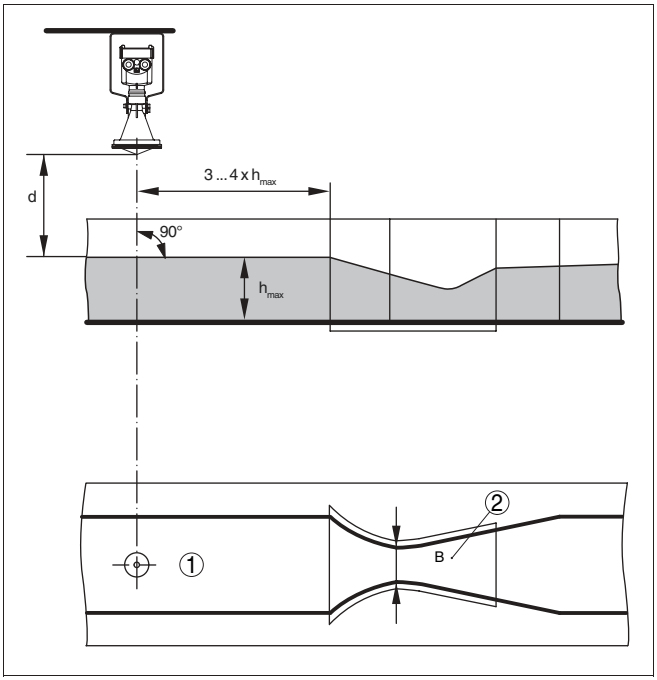


Fig. 16: Flow measurement with Khafagi-Venturi flume: d = Min. distance of the sensor; hmax. = max. filling of the flume; B = biggest throat of the flume
1 Position sensor
2 Venturi flume

Gauge measurement

The illustration shows an example for a gauge measurement.

In general, the following points must be observed:

- Installation of the sensor in a protected area
- Installation vertical to the liquid surface

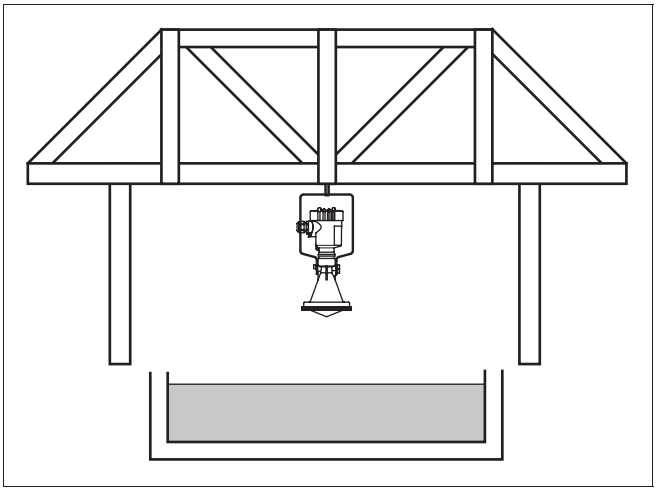


Fig. 17: Gauge measurement

5 Connecting to power supply

5.1 Preparing the connection

Note safety instructions

Always keep in mind the following safety instructions:

- Connect only in the complete absence of line voltage
- If overvoltage surges are expected, overvoltage arresters should be installed

Tip:
We recommend using VEGA overvoltage arresters ÜS-F-LB-I and ÜSB 62-36G.X.

Take note of safety instructions for Ex applications

In hazardous areas you should take note of the appropriate regulations, conformity and type approval certificates of the sensors and power supply units.

Select power supply

Power supply and current signal are carried on the same two-wire cable. The voltage supply range can differ depending on the instrument version.

The data for power supply are stated in chapter "*Technical data*" in the "*Supplement*".

Provide a reliable separation between the supply circuit and the mains circuits according to DIN VDE 0106 part 101. The VEGA power supply units VEGATRENN 149A Ex, VEGASTAB 690 as well as all VEGAMETs meet this requirement.

Bear in mind the following factors regarding supply voltage:

- Output voltage of the power supply unit can be lower under nominal load (with a sensor current of 20.5 mA or 22 mA in case of fault message)
- Influence of additional instruments in the circuit (see load values in chapter "*Technical data*").

Selecting connection cable

VEGAPULS 61 is connected with standard two-wire cable without screen. An outer cable diameter of 5 … 9 mm ensures the seal effect of the cable gland. If electromagnetic interference is expected which is above the test values of EN 61326 for industrial areas, screened cable should be used. For HART multidrop operation we recommend as standard practice the use of screened cable.

Cable gland ½ NPT

On VEGAPULS 61 with cable gland ½ NPT and plastic housing, a metal ½" threaded insert is moulded in the plastic housing.

28434-EN-070426

Caution:
No grease should be used when screwing the NPT cable gland or steel tube into the threaded insert. Standard grease can contain additives that corrode the connection between threaded insert and housing. This would influence the stability of the connection and the tightness of the housing.

Cable screening and grounding

If screened cable is necessary, connect the cable screen on both ends to ground potential. In the sensor, the screen must be connected directly to the internal ground terminal. The ground terminal on the outside of the housing must be connected to the potential equalisation (low impedance).

If potential equalisation currents are expected, the connection on the processing side must be made via a ceramic capacitor (e.g. 1 nF, 1500 V). The low frequency potential equalisation currents are thus suppressed, but the protective effect against high frequency interference signals remains.

Select connection cable for Ex applications

Take note of the corresponding installation regulations for Ex applications. In particular, make sure that no potential equalisation currents flow over the cable screen. In case of grounding on both sides this can be achieved by the use of a capacitor or a separate potential equalisation.

5.2 Connection steps - Instrument housing

Proceed as follows:

1 Unscrew the housing cover
2 If an indicating and adjustment module is installed, remove it by turning it slightly to the left.
3 Loosen compression nut of the cable entry
4 Remove approx. 10 cm (4 in) of the cable mantle, strip approx. 1 cm (0.4 in) insulation from the ends of the individual wires
5 Insert the cable into the sensor through the cable entry
6 Lift the opening levers of the terminals with a screwdriver (see following illustration)
7 Insert the wire ends into the open terminals according to the wiring plan

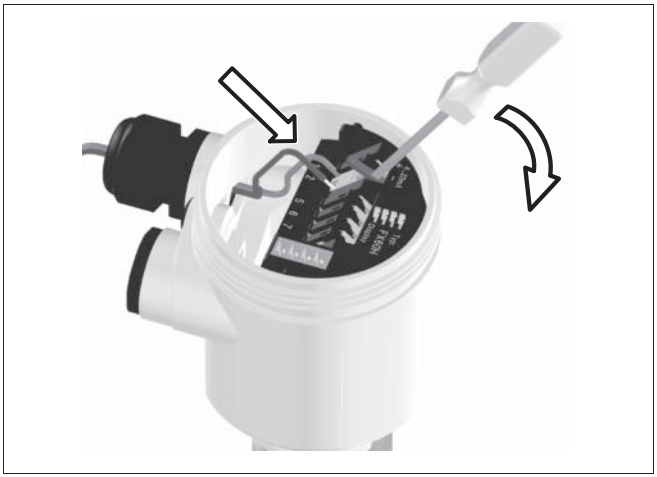


Fig. 18: Connection steps 6 and 7

8 Press down the opening levers of the terminals, you will hear the terminal spring closing

9 Check the hold of the wires in the terminals by lightly pulling on them

10 Connect the screen to the internal ground terminal and the external ground terminal to potential equalisation

11 Tighten the compression nut of the cable entry. The seal ring must completely encircle the cable

12 Screw the housing cover back on

The electrical connection is finished.

5.3 Wiring plan, single chamber housing

The following illustrations apply to the non-Ex as well as to the Ex ia version.

Housing overview

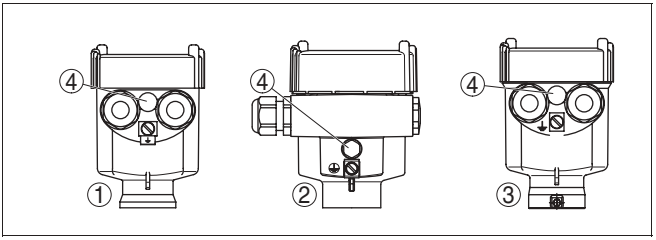


Fig. 19: Material versions, single chamber housing
1 Plastic
2 Aluminium
3 Stainless steel
4 Filter element for air pressure compensation of all material versions. Blind stopper with version IP 66/IP 68, 1 bar for Aluminium and stainless steel

Electronics and connection compartment

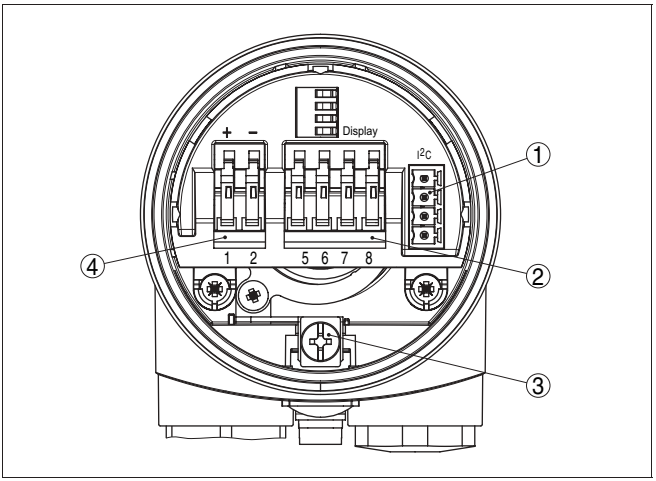


Fig. 20: Electronics and connection compartment, single chamber housing
1 Plug connector for VEGACONNECT (I^2C interface)
2 Spring-loaded terminals for connection of the external indication VEGADIS 61
3 Ground terminal for connection of the cable screen
4 Spring-loaded terminals for voltage supply

Wiring plan

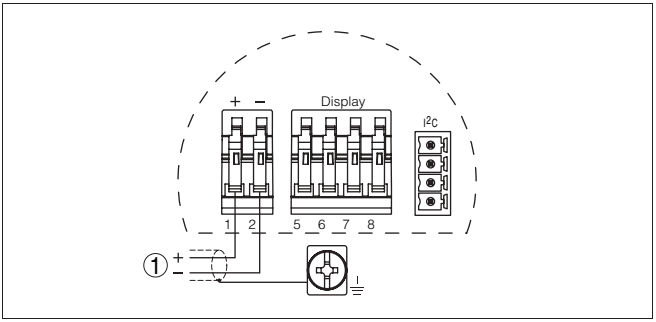


Fig. 21: Wiring plan, single chamber housing
1 Voltage supply/Signal output

5.4 Wiring plan, double chamber housing

The following illustration apply to non-Ex as well as Ex ia versions. The Exd version is described in the next subchapter.

Housing overview

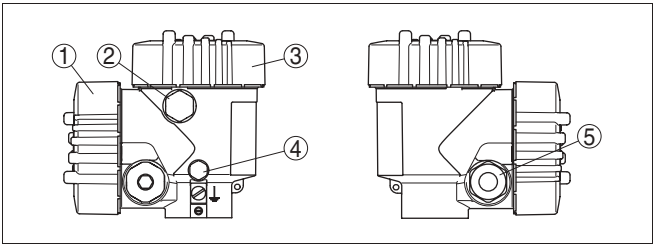


Fig. 22: Double chamber housing
1 Housing cover, connection compartment
2 Blind stopper or plug M12x1 for VEGADIS 61 (option)
3 Housing cover, electronics compartment
4 Filter element for pressure compensation or blind stopper with version IP 66/IP 68, 1 bar[2)]
5 Cable entry or plug

2) Version IP 66/IP 68, 1 bar not with four-wire instruments

Electronics compartment

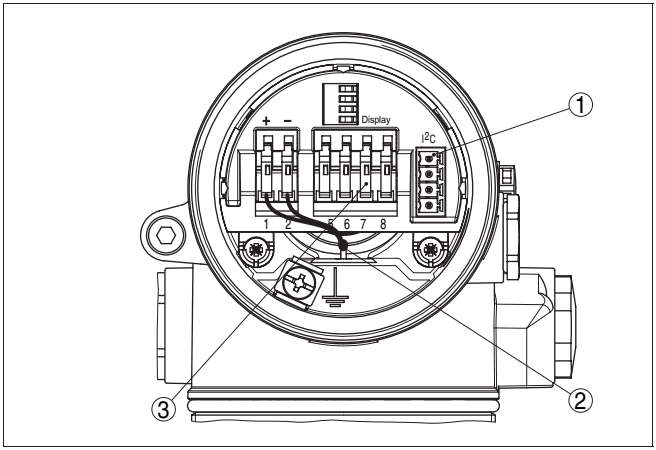


Fig. 23: Electronics compartment, double chamber housing
1 Plug connector for VEGACONNECT (I²C interface)
2 Internal connection cable to the connection compartment
3 Terminals for VEGADIS 61

Connection compartment

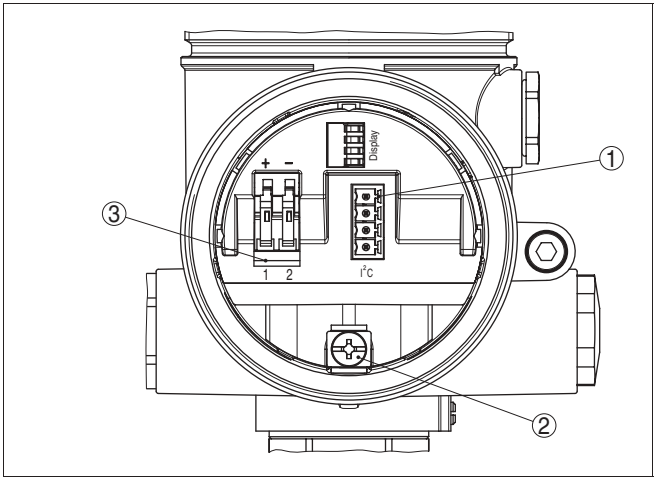


Fig. 24: Connection compartment, double chamber housing
1 Plug connector for VEGACONNECT (I²C interface)
2 Ground terminal for connection of the cable screen
3 Spring-loaded terminals for voltage supply

Wiring plan

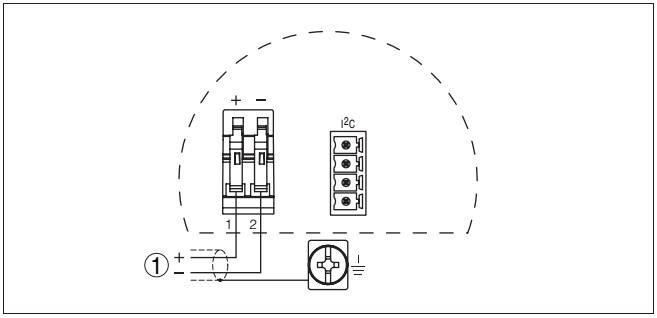


Fig. 25: Wiring plan, double chamber housing
1 Voltage supply/Signal output

5.5 Wiring plan, double chamber housing Exd

Housing overview

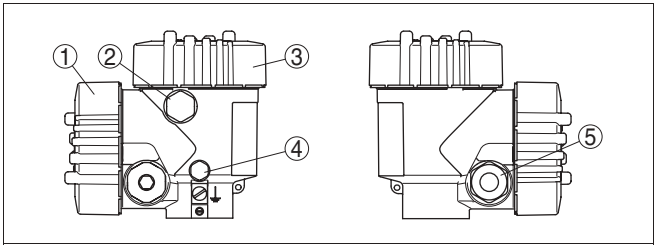


Fig. 26: Double chamber housing
1 Housing cover, connection compartment
2 Blind stopper or plug M12x1 for VEGADIS 61 (option)
3 Housing cover, electronics compartment
4 Filter element for pressure compensation or blind stopper with version IP 66/IP 68, 1 bar[3)]
5 Cable entry or plug

3) Version IP 66/IP 68, 1 bar not with four-wire instruments

Electronics compartment

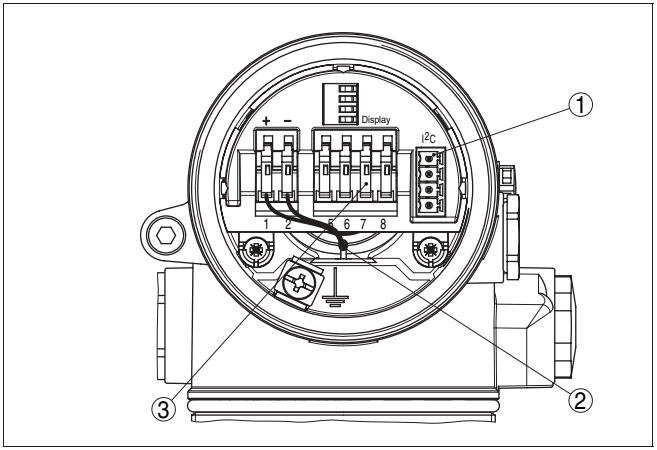


Fig. 27: Electronics compartment, double chamber housing
1 Plug connector for VEGACONNECT (I^2C interface)
2 Internal connection cable to the connection compartment
3 Terminals for VEGADIS 61

Connection compartment

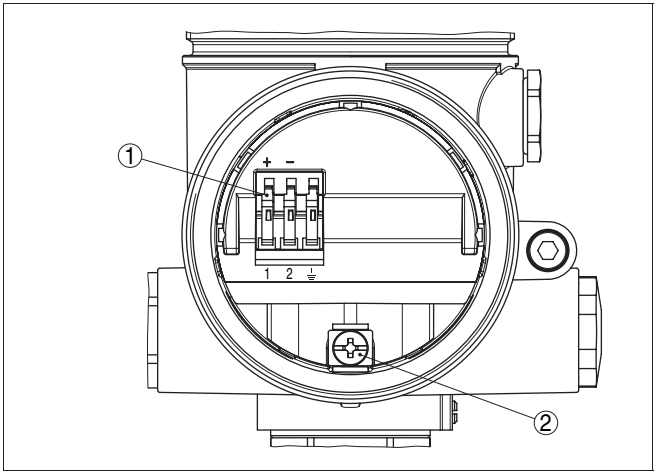


Fig. 28: Connection compartment, double chamber housing Exd
1 Spring-loaded terminals for power supply and cable screen
2 Ground terminal for connection of the cable screen

Wiring plan

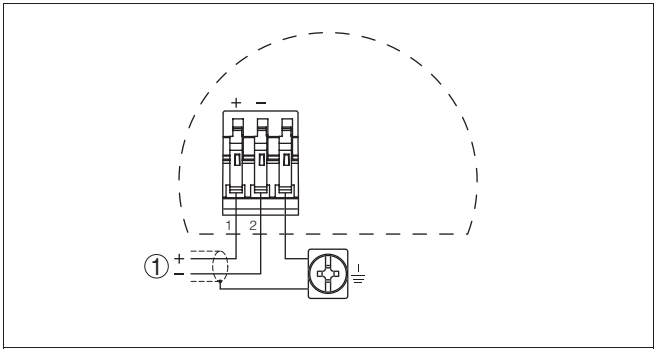


Fig. 29: Wiring plan, double chamber housing Exd
1 Voltage supply/Signal output

5.6 Wiring plan, version IP 66/IP 68, 1 bar

Wire assignment, connection cable

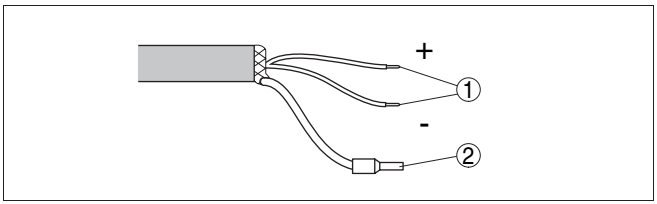


Fig. 30: Wire assignment, connection cable
1 brown (+) and blue (-) to power supply or to the processing system
2 Screen

5.7 Switch-on phase

Switch-on phase

After connecting VEGAPULS 61 to power supply or after a voltage recurrence, the instruments carries out a self-check for approx. 30 seconds:

- Internal check of the electronics
- Indication of the instrument type, the firmware as well as the sensor TAGs (sensor designation)
- Output signal jumps briefly (approx. 10 seconds) to the set fault current

Then the corresponding current is outputted to the cable (the value corresponds to the actual level as well as the settings already carried out, e.g. factory setting).

6 Set up with the indicating and adjustment module PLICSCOM

6.1 Short description

Function/Configuration

The indicating and adjustment module is used for measured value display, adjustment and diagnosis. It can be mounted in the following housing versions and instruments:

- All sensors of the plics® instrument family, in the single as well as in the double chamber housing (optionally in the electronics or connection compartment)
- External indicating and adjustment unit VEGADIS 61

From a hardware version …- 01 or higher of the indicating and adjustment module as well as of the corresponding sensor, an integrated backlight can be switched on via the adjustment menu. The hardware version is stated on the type label of the indicating and adjustment module or the sensor electronics.

Information:
This function is available for instruments with national approvals such as e.g. according to CSA only at a later date.

Note:
You will find detailed information on the adjustment in the operating instructions manual of the "*Indicating and adjustment module*".

6.2 Insert indicating and adjustment module

Mount/dismount indicating and adjustment module

The indicating and adjustment module can be inserted into the sensor and removed again at any time. It is not necessary to interrupt the power supply.

Proceed as follows:

1 Unscrew the housing cover
2 Place the indicating and adjustment module in the desired position on the electronics (you can choose any one of four different positions - each displaced by 90°)
3 Press the indicating and adjustment module onto the electronics and turn it to the right until it snaps in.
4 Screw housing cover with inspection window tightly back on

Removal is carried out in reverse order.

The indicating and adjustment module is powered by the sensor, an additional connection is not necessary.

Fig. 31: Installation of the indicating and adjustment module

Note:
If you intend to retrofit VEGAPULS 61 with an indicating and adjustment module for continuous measured value indication, a higher cover with an inspection glass is required.

6.3 Adjustment system

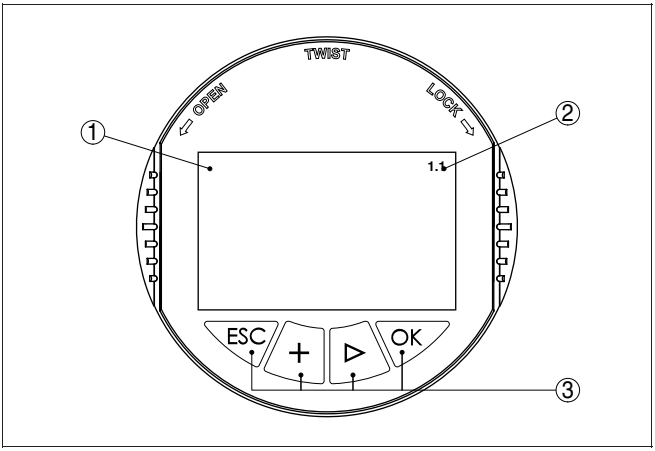


Fig. 32: Indicating and adjustment elements
1 LC display
2 Indication of the menu item number
3 Adjustment keys

Key functions

- ***[OK]*** key:
  - move to the menu overview
  - confirm selected menu
  - Edit parameter
  - Save value
- ***[->]*** key to select:
  - menu change
  - list entry
  - Select editing position
- ***[+]*** key:
  - Change value of a parameter
- ***[ESC]*** key:
  - interrupt input
  - jump to the next higher menu

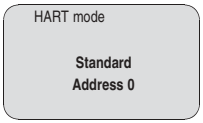
Adjustment system

The sensor is adjusted via the four keys of the indicating and adjustment module. The LC display indicates the individual menu items. The functions of the individual keys are shown in the above illustration. Approx. 10 minutes after the last pressing of a key, an automatic reset to measured value indication is triggered. Any values not confirmed with ***[OK]*** will not be saved.

6.4 Setup procedure

Address setting HART-Multidrop

In HART-Multidrop mode (several sensors on one input) the address must be set before continuing with the parameter adjustment. You will find a detailed description in the operating instructions manual "*Indicating and adjustment module*" or in the online help of PACTware™ or DTM.



Parameter adjustment

As VEGAPULS 61 is a distance measuring instrument, the distance from the sensor to the product surface is measured. To have the real product level displayed, an allocation of the measured distance to the percentage height must be made. To carry out this adjustment, the distance is entered with full and empty vessel. If these values are not known, an adjustment with the distance values, e.g. 10 % and 90 % is also possible. Starting point for these distance specifications is always the seal surface of the thread or flange. With these settings, the real level is calculated. Furthermore the operating range of the sensor is limited from maximum to the required range.

The real product level during this adjustment is not important, because the min./max. adjustment is always carried out without changing the product level. These settings can be made ahead of time without the instrument having to be installed.

Caution:
If there is a separation of liquids with different dielectric values in the vessel, e.g. from condensation, VEGAPULS 61 can detect under certain circumstances only the medium with the higher dielectric value.

Keep in mind that interfaces can cause faulty measurements.

If you want to measure the total height of both liquids reliably, please contact our service department or use an instrument specially designed for interface measurement.

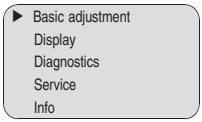
In the main menu item "*Basic adjustment*", the individual submenu items should be selected one after the other and provided with the correct parameter values.

Start your parameter adjustment with the following menu items of the basic adjustment:

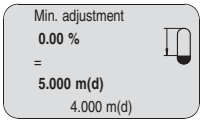
Carrying out min. adjustment

Proceed as follows:

1 Move from the measured value display to the main menu by pushing ***[OK]***.



2 Select the menu item "*Basic adjustment*" with ***[->]*** and confirm with ***[OK]***. Now the menu item "*Min. adjustment*" is displayed.



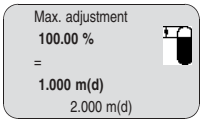
3 Prepare the % value for editing with ***[OK]*** and set the cursor to the requested position with ***[->]***. Set the requested percentage value with ***[+]*** and save with ***[OK]***. The cursor jumps now to the distance value.

4 Enter the appropriate distance value in m (corresponding to the percentage value) for the empty vessel (e.g. distance from the sensor to the vessel bottom).

5 Save the settings with ***[OK]*** and move to "Max. adjustment" with ***[->]***.

Carrying out max. adjustment

Proceed as follows:



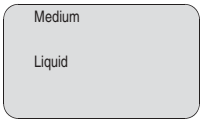
1 Prepare the % value for editing with ***[OK]*** and set the cursor to the requested position with ***[->]***. Set the requested percentage value with ***[+]*** and save with ***[OK]***. The cursor jumps now to the distance value.

2 Enter the appropriate distance value in m (corresponding to the percentage value) for the full vessel. Keep in mind that the max. level must lie below the dead band.

3 Save the settings with ***[OK]*** and move to "Medium selection" with ***[->]***.

Medium selection

Each product has different reflective properties. In addition, there are various interfering factors which have to be taken into account: agitated product surfaces and foam generation (with liquids); dust generation, material cones and echoes from the vessel wall (with solids). To adapt the sensor to these different conditions, you should first select "*Liquid*" or "*Solid*".



Information:
With VEGAPULS 61 with electronics version "*Increased safety*", "*Solid*" is preset as factory setting. However, the instrument should be used preferably in liquids. In such cases, the medium selection should be set to "*Liquid*" during setup.

According to the conductivity and the dielectric value of liquids, the reflection properties can differ considerably. Therefore additional options such as "*Solvent*", "*Chem. mixture*" and "*Water based*" are offered below the menu item Liquid.

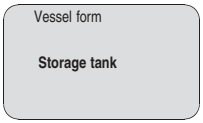
With solids, you can also choose between "*Powder/Dust*", "*Granular/Pellets*" or "*Ballast/Pebbels*".

Through this additional selection, the sensor is adapted perfectly to the product and measurement reliability, particularly in products with bad reflective properties, is considerably increased.

Enter the requested parameter via the appropriate keys, save your settings and jump to the next menu item with the ***[->]*** key.

Vessel form

Apart from the medium, the vessel shape can also influence the measurement. To adapt the sensor to these measuring conditions, this menu item offers different options depending on whether liquid or solid is selected. With "*Liquids*" these are "*Storage tank*", "*Stilling tube*", "*Open vessel*" or "*Stirred vessel*", with "*Solid*", "*Silo*" or "*Bunker*".



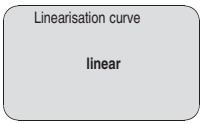
Information:
With VEGAPULS 61 with electronics version "*Increased*

safety", "*Solid*" is preset as factory setting. However, the instrument should be used preferably in liquids. In such cases, the vessel form should be set to "*Storage tank*" during setup.

Enter the requested parameter via the appropriate keys, save your settings and jump to the next menu item with the ***[->]*** key.

Linearisation curve

A linearization is necessary for all vessels in which the vessel volume does not increase linearly with the level - e.g. with a cylindrical or spherical tank - and the indication or output of the volume is required. Corresponding linearization curves are preprogrammed for these vessels. They represent the correlation between the level percentage and vessel volume. By activating the appropriate curve, the volume percentage of the vessel is displayed correctly. If the volume should not be displayed in percent but e.g. in l or kg, a scaling can be also set in the menu item "*Display*".



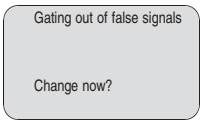
Enter the requested parameter via the appropriate keys, save your settings and jump to the next menu item with the ***[->]*** key.

Caution:
Note the following, if VEGAPULS 61 is used as part of an overfill protection system according to WHG:

If a linearisation curve is selected, the measuring signal is no longer compulsorily linear proportional to the level. This must be taken into consideration by the user, particularly when adjusting the switching point on the level switch.

Gating out of false signals

High sockets or vessel installations, such as e.g. struts or agitators as well as buildup and weld joints on the vessel walls cause interfering reflections which can impair the measurement. A false echo storage detects and marks these false echoes, so that they are no longer taken into account for the level measurement. A false echo memory should be created with empty vessel so that all potential interfering reflections will be detected.



Proceed as follows:

1 Move from the measured value display to the main menu by pushing ***[OK]***.

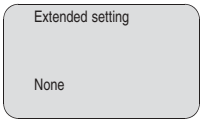
2 Select the menu item "*Service*" with ***[->]*** and confirm with ***[OK]***. Now the menu item "*False signal suppression*" is displayed.

3 Confirm "*False signal suppression - Change now*" with ***[OK]*** and select in the below menu "*Create new*". Enter the actual distance from the sensor to the product surface. All false signals in this area are detected by the sensor and saved after confirming with ***[OK]***.

Note:
Check the distance to the product surface, because if an incorrect (too large) value is entered, the existing level will be saved as false signal. The filling level would then no longer be detectable in this area.

Extended setting/Quick level change

The menu item "*Extended setting*" offers the possibility to optimise VEGAPULS 61 for applications with quick level changes. For this purpose select the function "*Quick level change >1 m/min.*".



Note:
Since with the function "*Quick level change >1 m/min.*" the generation of an averafy value of the signal processing is considerably reduced, false reflections by agitators or vessel installations can cause measured value fluctuations. A false echo memory is thus recommended.

Copy sensor data

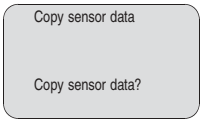
This function enables reading out parameter adjustment data as well as writing parameter adjustment data into the sensor via the indicating and adjustment module. A description of the function is available in the operating instructions manual "*Indicating and adjustment module*".

The following data are read out or written with this function:

- Measured value presentation
- Adjustment
- Medium
- Inner diameter of the standpipe (with standpipe versions)
- Vessel form
- Damping
- Linearisation curve
- Sensor-TAG
- Displayed value
- Display unit
- Scaling
- Current output
- Unit of measurement
- Language

The following safety-relevant data are **not** read out or written:

- HART mode
- PIN
- SIL



Reset

Basic adjustment

If the "*Reset*" is carried out, the sensor resets the values of the following menu items to the reset values (see chart):[4)]

Menu item	Reset value
Max. adjustment	0 m(d)
Min. adjustment	30 m(d) (VEGAPULS 61, 63, 65, 67) 35 m(d) (VEGAPULS 62, 66) 70 m(d) (VEGAPULS 68)
Medium	Liquid
Vessel form	not known
Damping	0 s
Linearization	linear
Sensor-TAG	Sensor
Displayed value	Distance
Extended settings	None

4) Sensor-specific basic adjustment.

Current output - characteristics	4 … 20 mA
Current output - max. current	20 mA
Current output - min. current	4 mA
Current output - failure	<3.6 mA
Unit of measurement	m(d)

The values of the following menu items are *not* reset to the reset values (see chart) with "**Reset**":

Menu item	**Reset value**
Lighting	no reset
Language	no reset
SIL	no reset
HART mode	no reset

Factory setting
Like basic setting, in addition special parameters are reset to default values.[5)]

Pointer
The min. and max. distance values are reset to the actual value.

Optional settings

Additional adjustment and diagnosis options such as e.g. scaling, simulation or trend curve presentation are shown in the following menu schematic. You will find a detailed description of these menu items in the operating instructions manual "*Indicating and adjustment module*".

[5)] Special parameters are parameters which are set customer-specifically on the service level with the adjustment software PACTware™.

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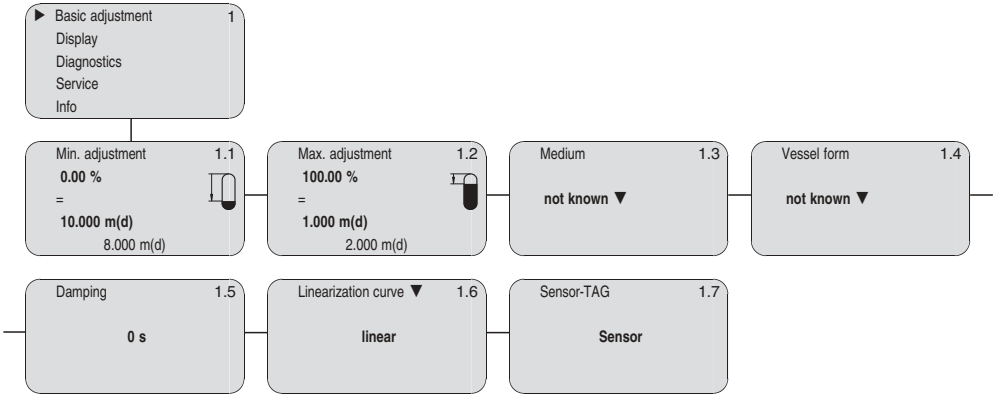
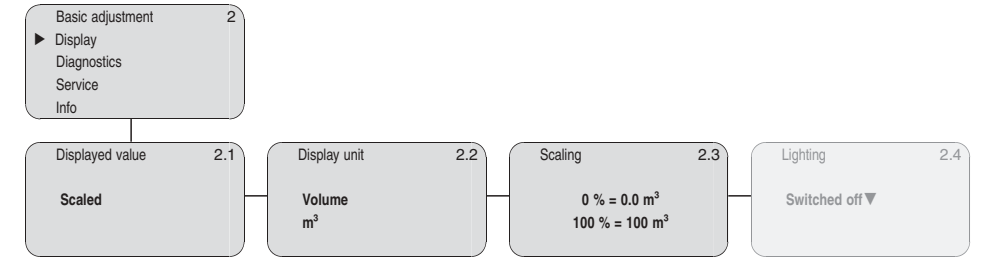
6.5 Menu schematic

Information:
Depending on the version and application, the light-coloured menu windows are not always available or offer nor selection possibility.

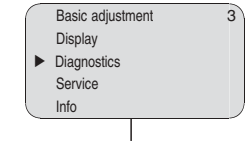
Basic adjustment

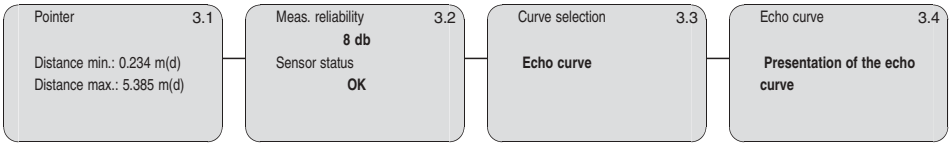


Display

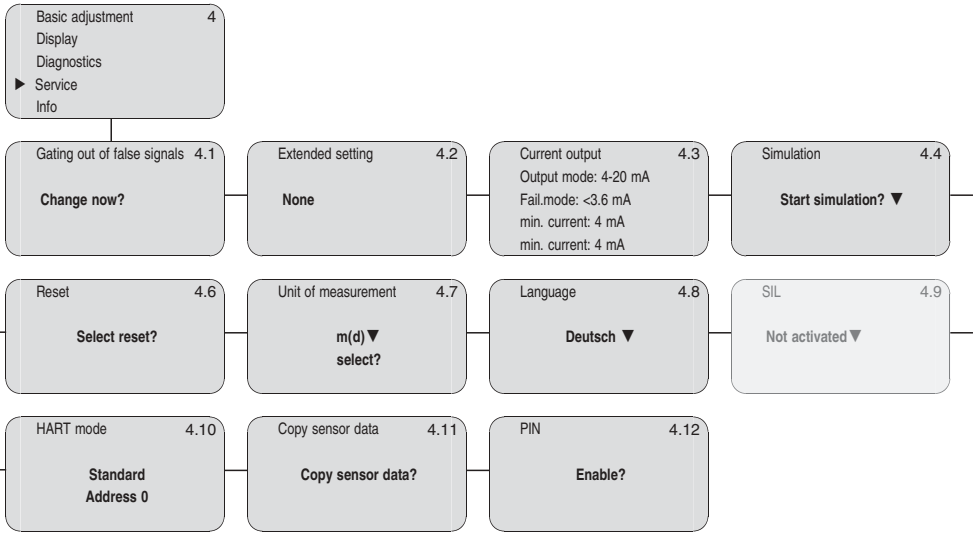


Diagnostics

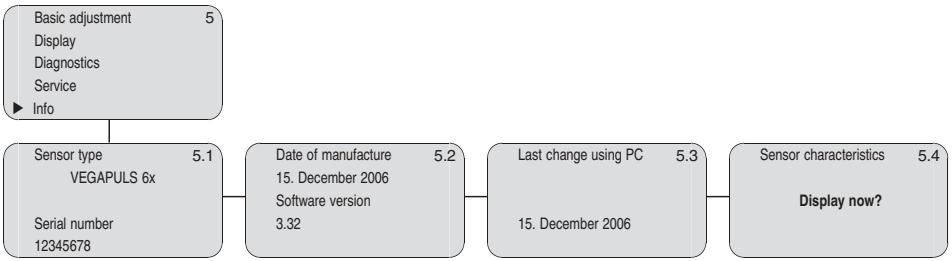




Service



Info



6.6 Saving the parameter adjustment data

It is recommended noting the adjusted data, e.g. in this operating instructions manual and archive them afterwards. They are hence available for multiple use or service purposes.

If VEGAPULS 61 is equipped with an indicating and adjustment module, the most important data can be read out of the sensor into indicating and adjustment module. The procedure is described in the operating instructions manual "*Indicating and adjustment module*" in the menu item "*Copy sensor data*". The data remain there permanently even if the sensor power supply fails.

If it is necessary to exchange the sensor, the indicating and adjustment module is inserted into the replacement instrument and the data are written into the sensor under the menu item "*Copy sensor data*".

7 Setup with PACTware™ and other adjustment programs

7.1 Connecting the PC

Connection via I²C interface

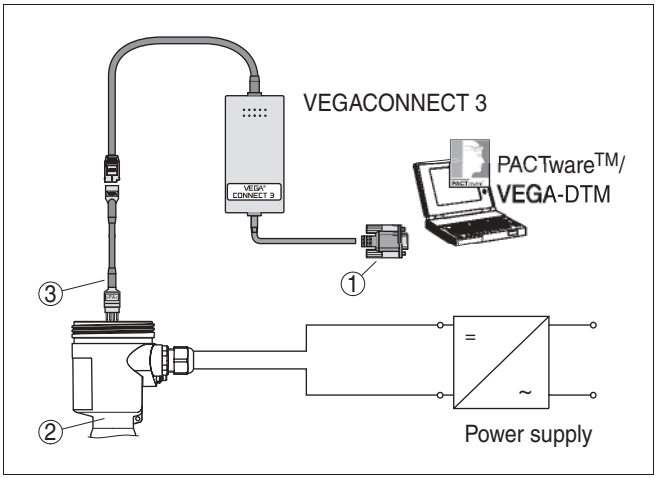


Fig. 33: Connection of the PC via I²C-C interface directly on the sensor
1 RS232 connection
2 VEGAPULS 61
3 I²C adapter cable for VEGACONNECT 3

Necessary components:

- VEGAPULS 61
- PC with PACTware™ and suitable VEGA DTM
- VEGACONNECT 3 with I²C adapter cable (article no. 2.27323)
- Power supply unit

Connection via HART

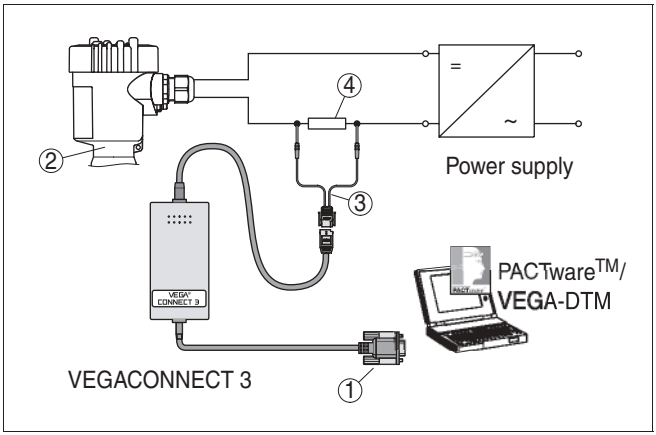


Fig. 34: Connecting the PC via HART to the signal cable
1 RS232 connection
2 VEGAPULS 61
3 HART adapter cable for VEGACONNECT 3
4 HART resistance 250 Ohm

Necessary components:

- VEGAPULS 61
- PC with PACTware™ and suitable VEGA DTM
- VEGACONNECT 3 with HART adapter cable (art. no. 2.25397)
- HART resistance approx. 250 Ohm
- Power supply unit

Note:
With power supply units with integrated HART resistance (internal resistance approx. 250 Ohm), an additional external resistance is not necessary. This applies, e.g. to the VEGA instruments VEGATRENN 149A, VEGADIS 371, VEGAMET 381). Also usual Ex separators are most of the time equipped with a sufficient current limitation resistor. In such cases, VEGACONNECT 3 can be connected parallel to the 4 … 20 mA cable.

7.2 Parameter adjustment with PACTware™

Further setup steps are described in the operating instructions manual "*DTM Collection/PACTware™*" attached to each CD and which can also be downloaded from our homepage. A detailed description is available in the online help of PACTware™ and the VEGA DTMs.

Note:
Keep in mind that for setup of VEGAPULS 61, DTM-Collection in the actual version must be used.

All currently available VEGA DTMs are provided in the DTM Collection on CD and can be obtained from the responsible VEGA agency for a token fee. This CD includes also the up-to-date PACTware™ version. The basic version of this DTM Collection incl. PACTware™ is also available as a free-of-charge download from the Internet.

Go via www.vega.com and "*Downloads*" to the item "*Software*".

7.3 Parameter adjustment with AMS™ and PDM

For VEGA sensors, instrument descriptions for the adjustment programs AMS™ and PDM are available as DD or EDD. The instrument descriptions are already implemented in the current versions of AMS™ and PDM. For older versions of AMS™ and PDM, a free-of-charge download is available via Internet.

Go via www.vega.com and "*Downloads*" to the item "*Software*".

7.4 Saving the parameter adjustment data

It is recommended to document or save the parameter adjustment data. They are hence available for multiple use or service purposes.

The VEGA DTM Collection and PACTware™ in the licensed, professional version provide suitable tools for systematic project documentation and storage.

8 Maintenance and fault rectification

8.1 Maintenance

When used as directed in normal operation, VEGAPULS 61 is completely maintenance free.

8.2 Remove interferences

Causes of malfunction

VEGAPULS 61 offers maximum reliability. Nevertheless faults can occur during operation. These may be caused by the following, e.g.:

- Sensor
- Process
- Supply
- Signal processing

Fault clearance

The first measures to be taken are to check the output signals as well as to evaluate the error messages via the indicating and adjustment module. The procedure is described below. Further comprehensive diagnostics can be carried out on a PC with the software PACTware™ and the suitable DTM. In many cases, the causes can be determined in this way and faults can be rectified.

24 hour service hotline

However, should these measures not be successful, call the VEGA service hotline in urgent cases under the phone no. **+49 1805 858550**.

The hotline is available to you 7 days a week round-the-clock. Since we offer this service world-wide, the support is only available in the English language. The service is free of charge, only the standard telephone costs will be charged.

Checking the 4 … 20 mA signal

Connect a handheld multimeter in the suitable measuring range according to the wiring plan.

? 4 … 20 mA signal not stable

- Level fluctuations

→ Set integration time via the indicating/adjustment module

? 4 … 20 mA signal missing

- Wrong connection

→ Check connection according to chapter "*Connection steps*" and if necessary, correct according to chapter "*Wiring plan*"

- No voltage supply

→ Check cables for breaks; repair if necessary

- supply voltage too low or load resistance too high

→ Check, adapt if necessary

? Current signal greater than 22 mA or less than 3.6 mA

- Electronics module defective

→ Exchange instrument or return instrument for repair

In Ex applications, the regulations for the wiring of intrinsically safe circuits must be observed.

Fault messages via the indicating/adjustment module

? E013

- no measured value available

→ sensor in boot phase

→ sensor does not find an echo, e.g. because of faulty installation or incorrect parameter adjustment

? E017

- Adjustment span too small

→ Carry out a fresh adjustment and increase the distance between min. and max. adjustment

? E036

- no operable sensor software

→ Carry out a software update or send the instrument for repair

? E041, E042, E043

- Hardware error, electronics defective

→ Exchange instrument or return instrument for repair

8.3 Exchange of the electronics module

If the electronics module is defective, it can be replaced by the user.

In Ex applications, only an instrument and an electronics module with appropriate Ex approval may be used.

If there is no electronics module available on site, one can be ordered from the VEGA agency serving you.

Sensor serial number

The order data of the sensor must be downloaded into the new electronics module. This can be done:

- at the factory by VEGA
- or on site by the user

In both cases, the sensor serial number is necessary. The serial numbers are stated on the type label of the instrument, inside the housing or on the delivery note.

Information:
When loading on site, the order data must be downloaded from the Internet (see Operating Instructions manual "*Oscillator*").

Assignment

The oscillators are adapted to the respective sensor and differ in their signal output or in their power supply. You can find a suitable oscillator in the following overview.

4 … 20 mA/HART

Oscillator PS-E.60**KH** is suitable for **K** band VEGAPULS 61, 62, 63 - 4 … 20 mA/HART. The following versions are available which differ in the approvals:

- PS-E.60KH**X** (X = without approvals)
- PS-E.60KH**A** (A = approvals CA, DA, EA according to VEGA product list)
- PS-E.60KH**D** (D = approvals KX, KF according to VEGA product list)
- PS-E.60KH**E** (E = approvals CX, DX, CK, CI, DM, XM, CM, DI, EX, GI, GX, UX, UF according to VEGA product list)

4 … 20 mA/HART with increased sensitivity

Oscillator PS-E.60**KD** is suitable for **K** band VEGAPULS 61, 62, 63 - 4 … 20 mA/HART with increased sensitivity. The following versions are available differing in the approvals:

- PS-E.60KD**X** (X = without approvals)
- PS-E.60KD**A** (A = approvals CA, DA, EA according to VEGA product list)

- PS-E.60KD**D** (D = approvals KX, KF according to VEGA product list)
- PS-E.60KD**E** (E = approvals CX, DX, CK, CI, DM, XM, CM, DI, EX, GI, GX, UX, UF according to VEGA product list)

8.4 Instrument repair

If a repair is necessary, please proceed as follows:

You can download a return form (23 KB) from the Internet on our homepage www.vega.com under: "*Downloads - Forms and certificates - Repair form*".

By doing this you help us carry out the repair quickly and without having to call for needed information.

- Print and fill out one form per instrument
- Clean the instrument and pack it damage-proof
- Attach the completed form and, if need be, also a safety data sheet outside on the packaging
- Please ask the agency serving you for the address of your return shipment. You can find the respective agency on our website www.vega.com under: "*Company - VEGA worldwide*"

9 Dismounting

9.1 Dismounting steps

Warning:
Before dismounting, be aware of dangerous process conditions such as e.g. pressure in the vessel, high temperatures, corrosive or toxic products etc.

Take note of chapters "*Mounting*" and "*Connecting to power supply*" and carry out the listed steps in reverse order.

9.2 Disposal

The instrument consists of materials which can be recycled by specialised recycling companies. We use recyclable materials and have designed the electronics to be easily separable.

WEEE directive 2002/96/EG
This instrument is not subject to the WEEE directive 2002/96/EG and the respective national laws (in Germany, e.g. ElektroG). Pass the instrument directly on to a specialised recycling company and do not use the municipal collecting points. These may be used only for privately used products according to the WEEE directive.

Correct disposal avoids negative effects to persons and environment and ensures recycling of useful raw materials.

Materials: see chapter "*Technical data*"

If you cannot dispose of the instrument properly, please contact us about disposal methods or return.

10 Supplement

10.1 Technical data

General data

316L corresponds to 1.4404 or 1.4435, 304 corresponds to 1.4301

Materials, wetted parts with encapsulated antenna system	
– Threaded fitting G1½ A and 1½ NPT	PVDF
– Hygienic fitting	Adapter of 316L
– Antenna	PVDF
– Seal thread	FPM
– Seal, bolting	FKM (Viton)
Materials, wetted parts with plastic horn antenna	
– Process fitting	thread G1½ A and 1½ NPT: PVDF, Tri-Clamp 2" and 3", bolting DN 50 and DN 80: adapter of 316L
– Horn antenna	PBT-GF30
– Focussing lens	PP
– Adapter flange	PPH
– Seal, adapter flange	FKM (Viton)
Materials, non-wetted parts	
– Compression flange	PPH
– Mounting strap	304
– Fixing screws, mounting strap	316L
– Fixing screws, adapter flange	304
– Housing	Plastic PBT (Polyester), Alu die-casting powder-coated, 316L
– Seal ring between housing and housing cover	NBR (stainless steel housing), silicone (Alu/plastic housing)
– Inspection window in housing cover for PLICSCOM	Polycarbonate (UL-746-C listed)
– Ground terminal	316Ti/316L
Max. torque, mounting screws - strap on the sensor housing	4 Nm
Weight	0.7 … 3.4 kg (1.5 … 7.5 lbs), depending on the process fitting and housing material

Output variable	
Output signal	4 … 20 mA/HART
Signal resolution	1.6 µA
Failure signal	Current output unchanged 20.5 mA, 22 mA, <3.6 mA (adjustable)
Max. output current	22 mA
Load	see load diagram under Power supply
Damping (63 % of the input variable)	0 … 999 s, adjustable
Fulfilled NAMUR recommendations	NE 43

Input variable	
Parameter	distance between process fitting and product surface
Min. distance from antenna end	50 mm (2 in)[6]
Recommended measuring range encapsulated antenna system	up to 10 m (33 ft)
Recommended measuring range plastic horn antenna	up to 20 m (66 ft)

Reference conditions to measuring accuracy (similar to DIN EN 60770-1)	
Reference conditions according to DIN EN 61298-1	
– Temperature	+18 … +30 °C (+64 … +86 °F)
– Relative humidity	45 … 75 %
– Air pressure	860 … 1060 mbar/86 … 106 kPa (12.5 … 15.4 psi)
Other reference conditions	
– Reflector	Ideal reflector, e.g. metal plate 2x2 m
– False reflections	Biggest false echo, 20 dB smaller than the useful echo

Characteristics and performance data	
Frequency	K-band (26 GHz technology)
Interval	approx. 1 s
Beam angle 3 dB	
– Encapculated antenna system	22°
– Plastic horn antenna	10°

[6] In products with low dielectric value up to 50 cm (19.7 in).

Step response or adjustment time[7]	>1 s (dependent on the parameter adjustment)
Max. level change	adjustable up to 1 m/min. (dependent on the parameter adjustment)

Received average emitted power reaching an object directly in front of the antenna

– Distance 1 m (3.28 ft)	108 nW per cm^2 (108^{-9} W/cm^2) or 108 nW per 0.155 in^2 ($108x10^{-9}$ W/0.155 in^2)
– Distance 5 m (16.404 ft)	4.3 nW per cm^2 (4.3^{-9} W/cm^2) or 4.3 nW per 0.155 in^2 ($4.3x10^{-9}$ W/0.155 in^2)

Measuring accuracy

Resolution, general	max. 1 mm (max. 0.039 in)
Deviation[8]	see diagrams

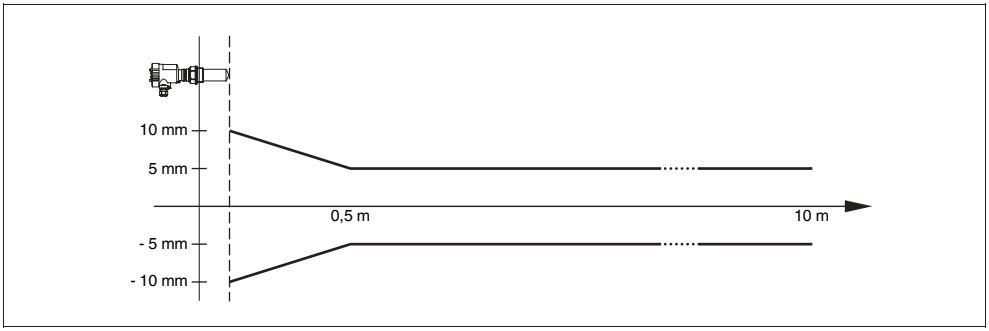


Fig. 35: Deviation VEGAPULS 61 with encapsulated antenna system in mm, measuring range in m

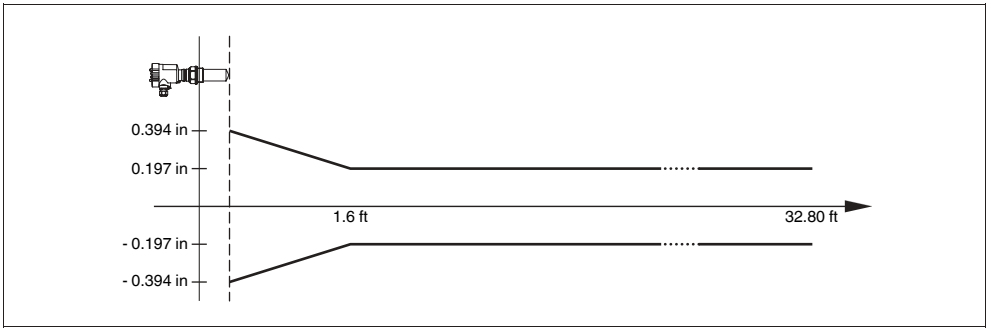


Fig. 36: Deviation VEGAPULS 61 with encapsulated antenna system in Inch, measuring range in ft

[7] Time to output the correct level (with max. 10 % deviation) after a sudden level change.

[8] Incl. non-linearity, hysteresis and non-repeatability.

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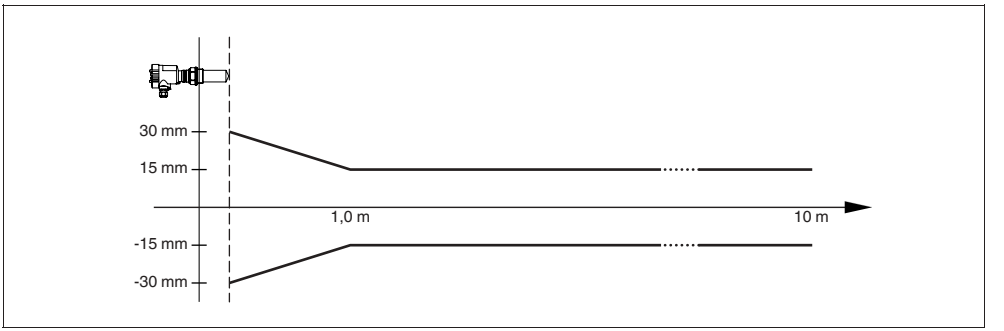


Fig. 37: Deviation VEGAPULS 61 with encapsulated antenna system and increased sensitivity in mm, measuring range in m

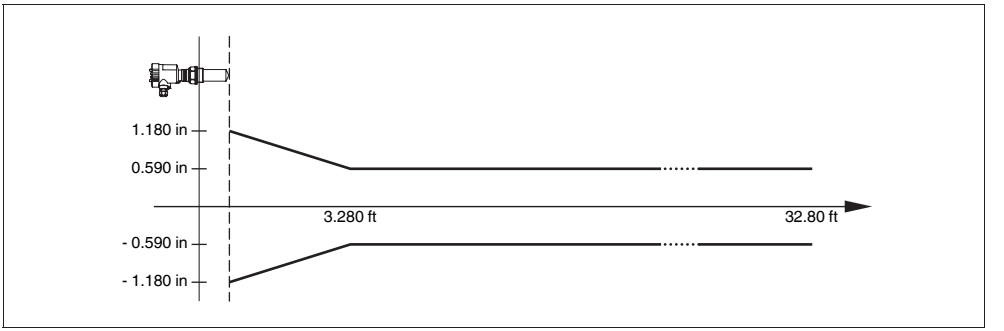


Fig. 38: Deviation VEGAPULS 61 with encapsulated antenna system and increased sensitivity in Inch, measuring range in ft

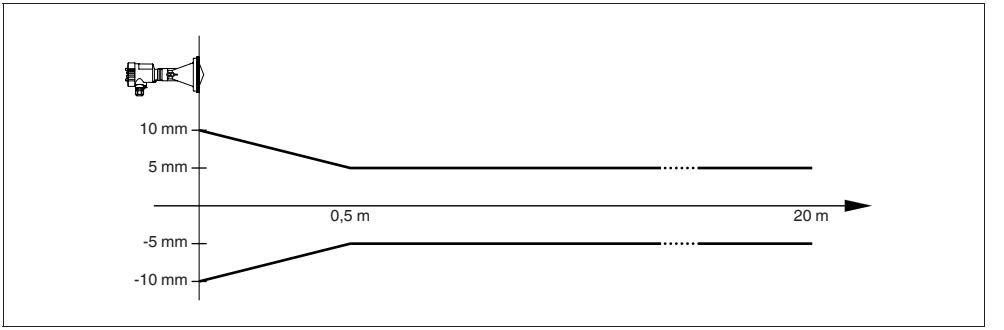


Fig. 39: Deviation VEGAPULS 61 with plastic horn antenna in mm, measuring range in m

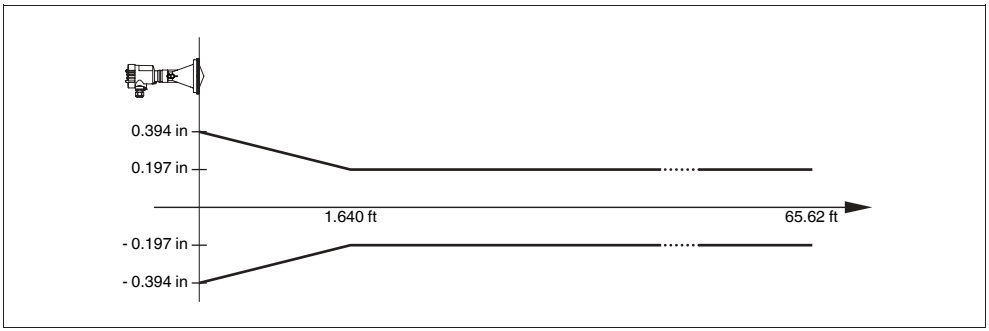


Fig. 40: Deviation VEGAPULS 61 with plastic horn antenna in inch, measuring range in ft

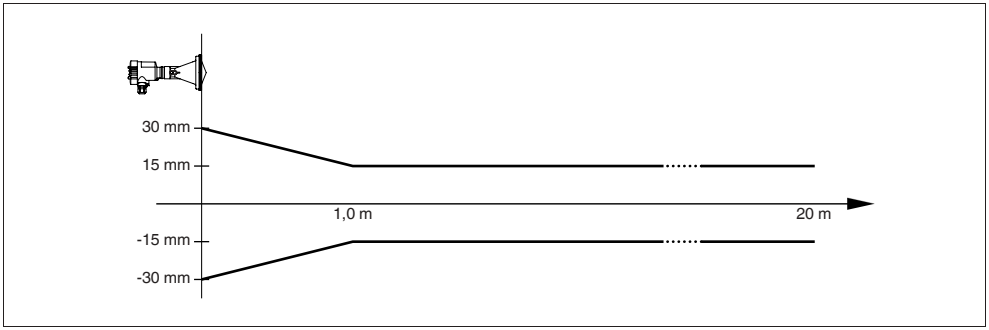


Fig. 41: Deviation VEGAPULS 61 with plastic horn antenna and increased sensitivity in mm, measuring range in m

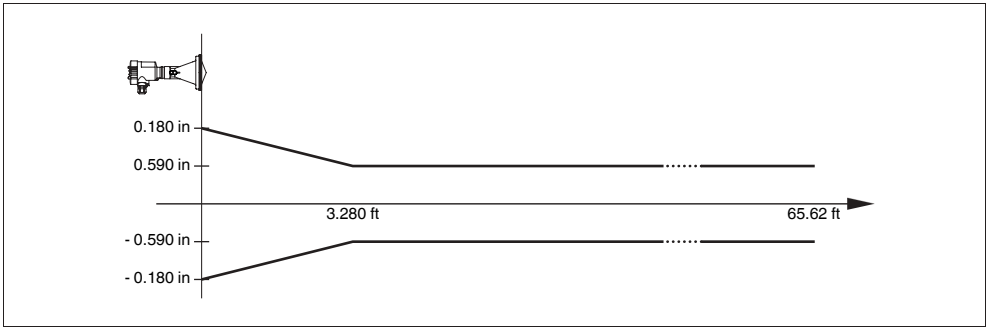


Fig. 42: Deviation VEGAPULS 61 with plastic horn antenna and increased sensitivity in Inch, measuring range in ft

Influence of the ambient temperature to the sensor electronics[9)]

[9)] Relating to the nominal measuring range.

Average temperature coefficient of the zero signal (temperature error)	0.03 %/10 K

Ambient conditions

Ambient, storage and transport temperature	-40 … +80 °C (-40 … +176 °F)

Process conditions

Vessel pressure	-100 … 300 kPa/-1 … 3 bar (-14.5 … 43.5 psi)
Process temperature (measured on the process fitting)	-40 … +80 °C (-40 … +176 °F)
Vibration resistance	mechanical vibrations with 4 g and 5 … 100 Hz[10]

Electromechanical data - version IP 66/IP 67 and IP 66/IP 68; 0.2 bar

Cable entry/plug[11]

– Single chamber housing
- 1x cable entry M20x1.5 (cable-ø 5 … 9 mm), 1x blind stopper M20x1.5

or:
- 1x cloasing cap M20x1.5, 1x blind stopper M20x1.5

or:
- 1x closing cap ½ NPT, 1x blind plug ½ NPT

or:
- 1x plug (depending on the version), 1x blind plug M20x1.5

– Double chamber housing
- 1x cable entry M20x1.5 (cable-ø 5 … 9 mm), 1x blind stopper M20x1.5; 1x blind stopper M16x1.5 or optionally 1x plug M12x1 for VEGADIS 61

or:
- 1x closing cap ½ NPT, 1x blind stopper ½ NPT, 1x blind stopper M16x1.5 or optionally 1x plug M12x1 for VEGADIS 61

or:
- 1x plug (depending on the version); 1x blind stopper M20x1.5; 1x blind stopper M16x1.5 or optionally 1x plug M12x1 for VEGADIS 61

[10] Tested according to the regulations of German Lloyd, GL directive 2
[11] Depending on the version M12x1, according to DIN 43650, Harting, Amphenol-Tuchel, 7/8" FF.

Spring-loaded terminals	for wire cross-sections up to 2.5 mm²

Electromechanical data - version IP 66/IP 68, 1 bar

Cable entry	
– Single chamber housing	1x IP 68 cable entry M20x1.5; 1x blind stopper M20x1.5
– Double chamber housing	1x IP 68 cable gland M20x1.5; 1x blind stopper M20x1.5; 1x blind stopper M16x1.5
Connection cable	
– Wire cross-section	0.5 mm²
– wire resistance	<0.036 Ohm/m
– Tensile strength	>1200 N (270 lbf)
– Standard length	5 m (16.404 ft)
– Max. length	1000 m (3280 ft)
– Min. bending radius	25 mm (0.984 in) at 25 °C (77 °F)
– Diameter	approx. 8 mm (0.315 in)
– Colour - standard PE	Black
– Colour - standard PUR	Blue
– Colour - Ex-version	Blue

Indicating and adjustment module

Power supply and data transmission	through the sensor
Indication	LC display in Dot matrix
Adjustment elements	4 keys
Protection	
– unassembled	IP 20
– mounted into the sensor without cover	IP 40
Materials	
– Housing	ABS
– Inspection window	Polyester foil

Voltage supply

Supply voltage

– Non-Ex instrument	14 … 36 V DC
– EEx ia instrument	14 … 30 V DC
– EExd ia instrument	20 … 36 V DC

Supply voltage with lighted indicating and adjustment module

– Non-Ex instrument	20 … 36 V DC
– EEx ia instrument	20 … 30 V DC
– EExd ia instrument	20 … 36 V DC

Permissible residual ripple

– <100 Hz	U_{ss} <1 V
– 100 Hz … 10 kHz	U_{ss} <10 mV

Load see diagram

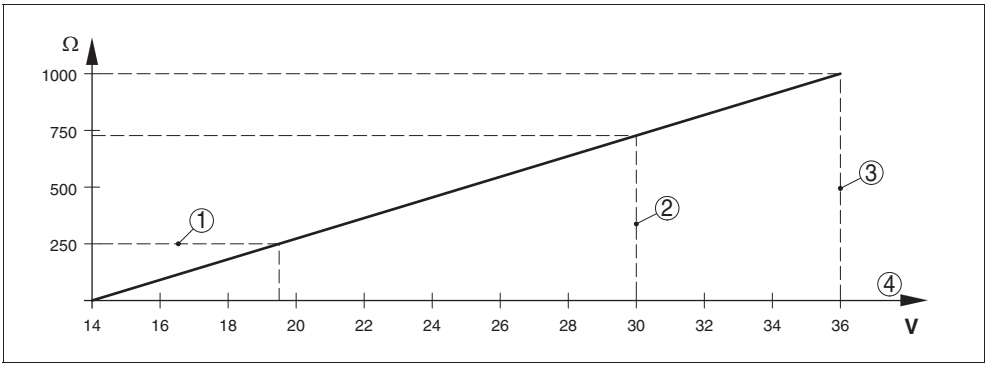


Fig. 43: Voltage diagram
1 HART load
2 Voltage limit EEx ia instrument
3 Voltage limit non-Ex/Ex instrument
4 Supply voltage

Voltage supply - Version with increased sensitivity

Supply voltage

– Non-Ex instrument	15 … 36 V DC
– EEx ia instrument	15 … 30 V DC
– EExd ia instrument	20 … 36 V DC

Supply voltage with lighted indicating and adjustment module

– Non-Ex instrument	20 … 36 V DC
– EEx ia instrument	20 … 30 V DC
– EExd ia instrument	20 … 36 V DC

Permissible residual ripple

– <100 Hz	U_{ss} <1 V
– 100 Hz … 10 kHz	U_{ss} <10 mV

Load see diagram

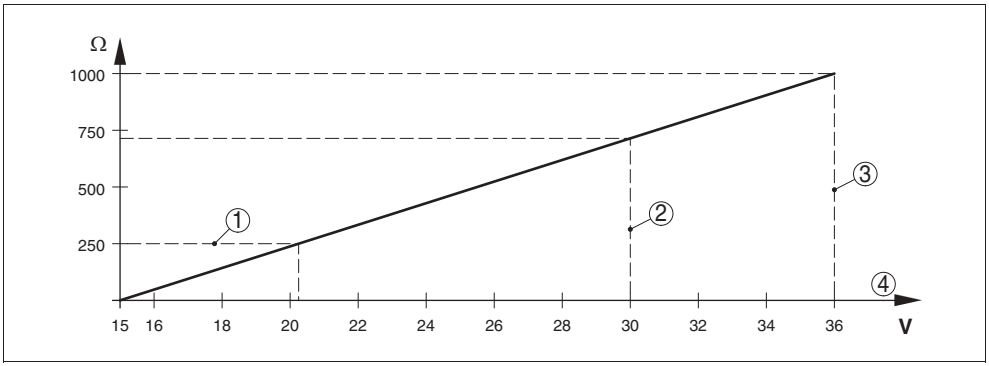


Fig. 44: Voltage diagram for version with increased sensitivity
1 HART load
2 Voltage limit EEx ia instrument
3 Voltage limit non-Ex/Ex instrument
4 Supply voltage

Electrical protective measures

Protection

– Plastic housing	IP 66/IP 67
– Alu and stainless steel standard	IP 66/IP 68 (0.2 bar)[12)]
– Alu and stainless housing (optionally available)	IP 66/IP 68 (1 bar)
Overvoltage category	III
Protection class	II

[12)] Prerequisite for maintaining the protection is a suitable cable.

Functional safety (SIL)

Functional safety according to IEC 61508/IEC 61511

– Single channel architecture 1oo1D	up to SIL2
– double channel diversitary redundant architecture (1oo2D)	up to SIL3

Approvals[13)]

ATEX ia	ATEX II 1G, 1/2G, 2G EEx ia IIC T6
ATEX ia+d	ATEX II 1/2G, 2G Exd ia IIC T6
ATEX D	ATEX II 1/2D IP6X T
IEC ia	IEC Ex ia IIC T6
FM	FM Cl.I, Div2 (NI)+Cl.II, III, Div1 (DIP); FM Cl.I-III, Div 1 (IS); FM Cl.I-III, Div 1 (IS)+Cl.I-III, Div 1 Gr.C-G(XP)
CSA	CSA Cl.I, Div2 (NI)+Cl.II, III, Div1 (DIP); CSA Cl.I-III, Div 1 (IS); CSA Cl.I-III, Div 1 (IS)+Cl.I-III, Div 1 Gr.C-G(XP)
Ship approvals	GL, LRS, ABS, CCS, RINA
Others	WHG

13) Available or applied for, depending on the order specification. Deviating data with Ex applications: see separate safety instructions.

10.2 Dimensions

Housing in protection IP 66/IP67 and IP 66/IP 68; 0.2 bar

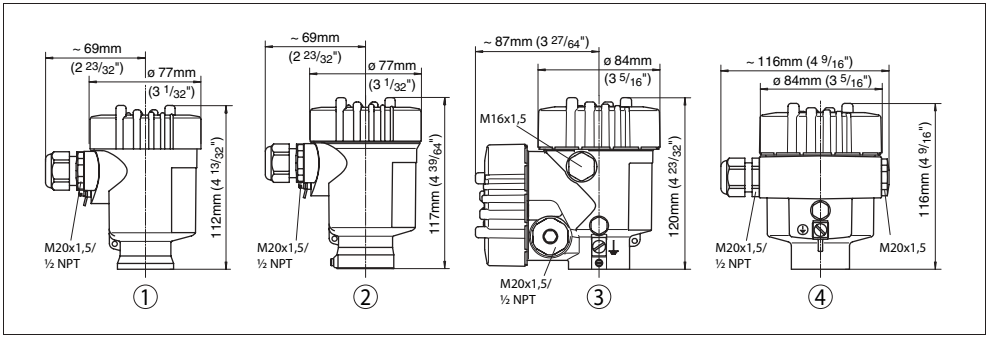


Fig. 45: Housing versions in protection IP 66/IP 67 and IP 66/IP 68; 0.2 bar, with integrated indicating and adjustment module the housing is 9 mm (1/64") higher

1 *Plastic housing*
2 *Stainless steel housing*
3 *Aluminium double chamber housing*
4 *Aluminium housing*

Housing in protection IP 66/IP 68, 1 bar

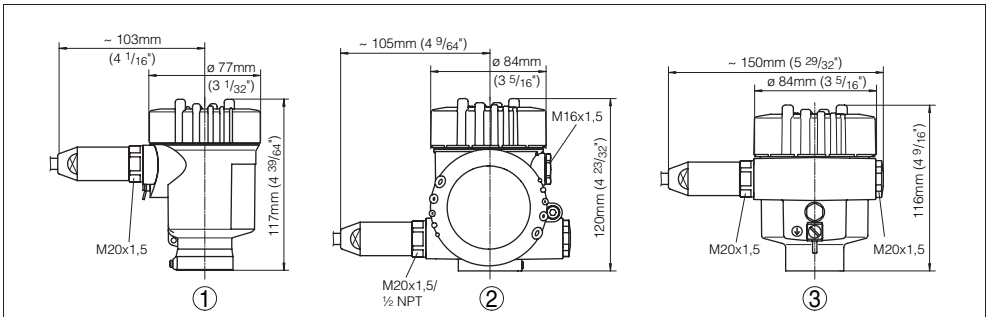


Fig. 46: Housing versions in protection IP 66/IP 68, 1 bar (with integrated indicating and adjustment module the housing is 9 mm/0.4 in higher)

1 *Stainless steel housing*
2 *Aluminium double chamber housing*
3 *Aluminium housing*

VEGAPULS 61, threaded version

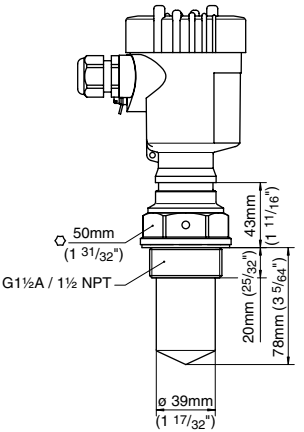


Fig. 47: VEGAPULS 61 - Threaded version G1½ A and 1½ NPT

VEGAPULS 61, hygienic fitting

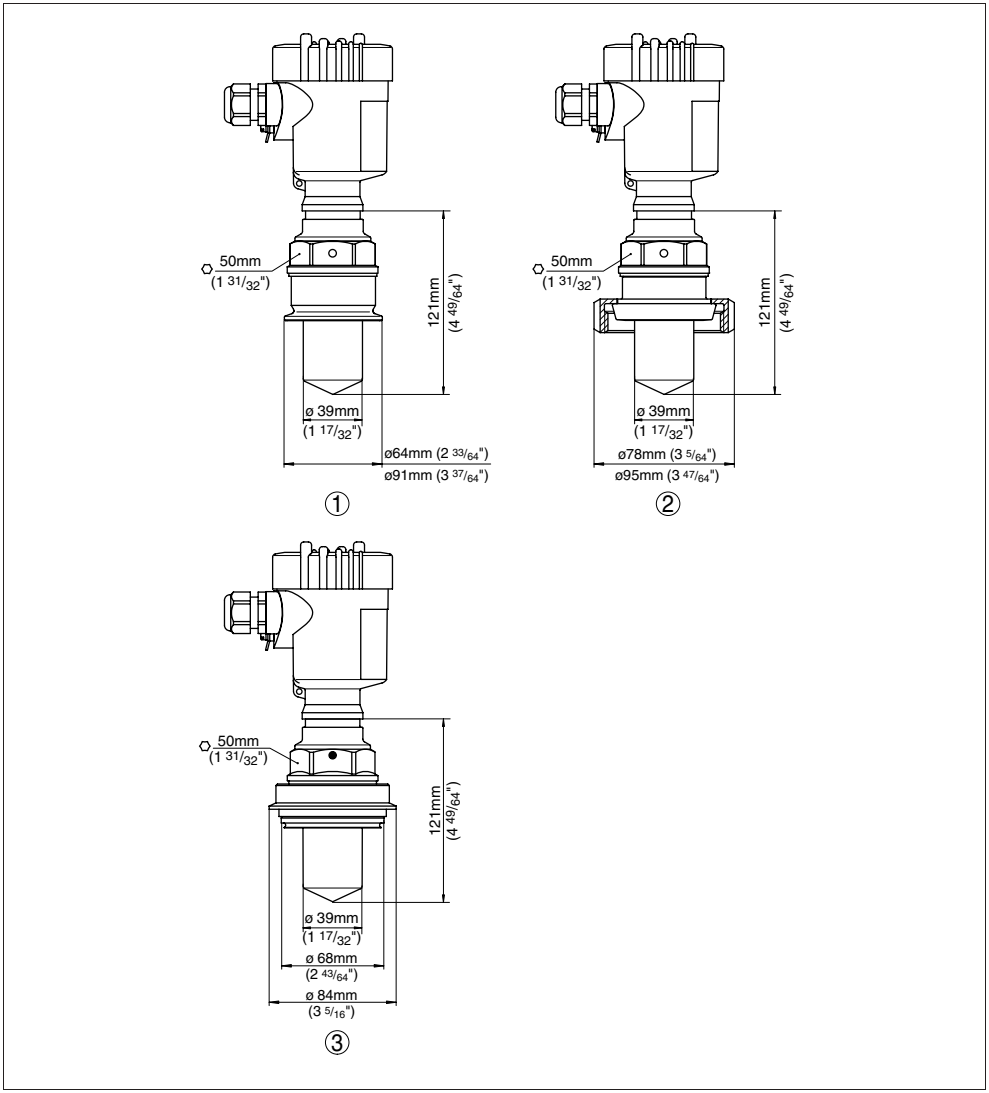


Fig. 48: VEGAPULS 61, hygienic fitting
1 Tri-Clamp 2" and 3"
2 Bolting according to DIN 11851 DN 50 and DN 80
3 Tuchenhagen Varivent DN 32

VEGAPULS 61, version with mounting strap

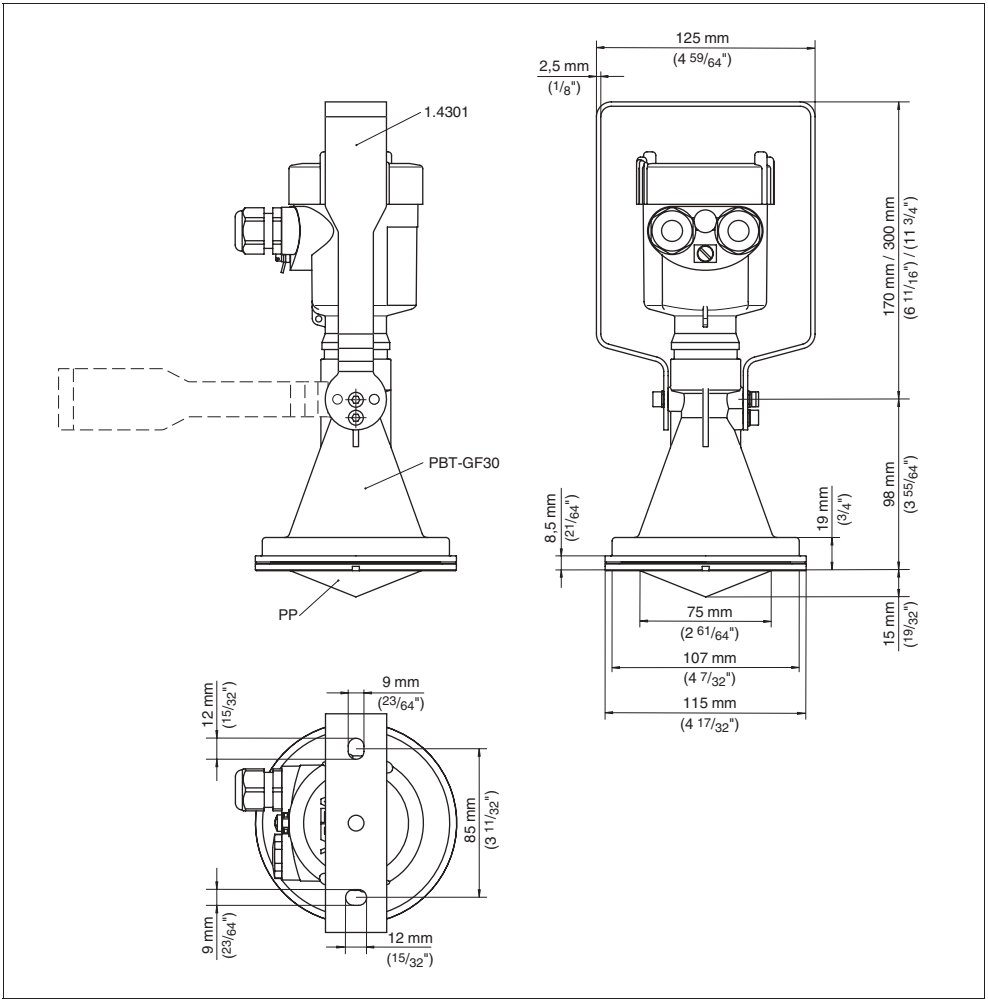


Fig. 49: VEGAPULS 61, version with mounting loop in 170 or 300 mm length

VEGAPULS 61, version with compression flange

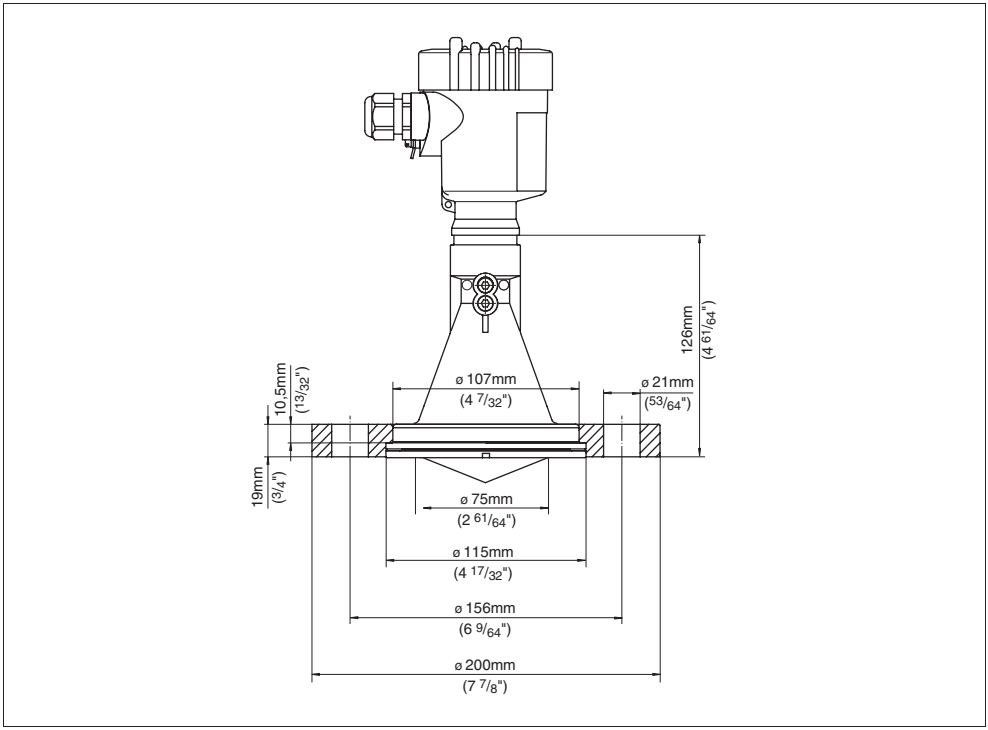
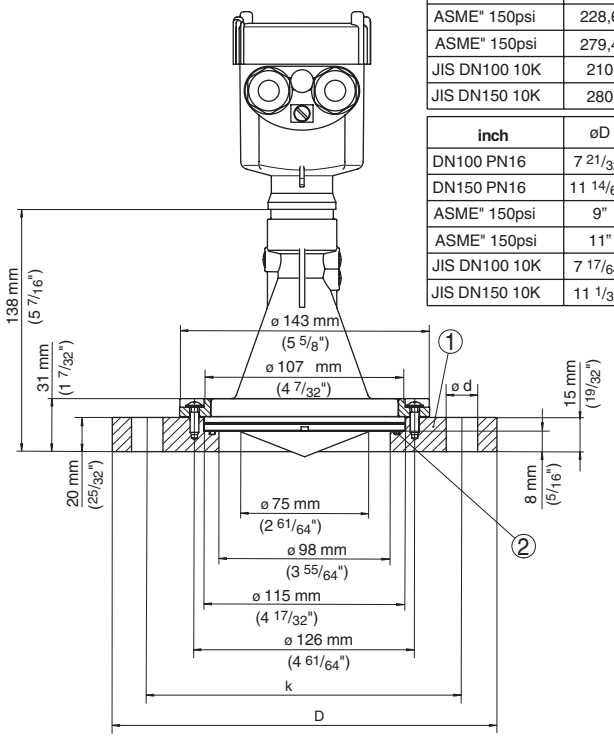


Fig. 50: VEGAPULS 61, compression flange DN 80/3"/JIS80

VEGAPULS 61, version with adapter flange



mm	øD	øk	ød	
DN100 PN16	220	180	18	8x45°(=360°)
DN150 PN16	285	240	22	8x45°(=360°)
ASME" 150psi	228,6	190,5	19,1	8x45°(=360°)
ASME" 150psi	279,4	241,3	22,4	8x45°(=360°)
JIS DN100 10K	210	175	19	8x45°(=360°)
JIS DN150 10K	280	240	23	8x45°(=360°)

inch	øD	øk	ød	
DN100 PN16	7 21/32"	7 3/32"	45/64"	8x45°(=360°)
DN150 PN16	11 14/64"	9 29/64"	55/64"	8x45°(=360°)
ASME" 150psi	9"	7 1/2"	3/4"	8x45°(=360°)
ASME" 150psi	11"	9 1/2"	7/8"	8x45°(=360°)
JIS DN100 10K	7 17/64"	6 57/64"	3/4"	8x45°(=360°)
JIS DN150 10K	11 1/32"	9 29/64"	29/32"	8x45°(=360°)

Fig. 51: VEGAPULS 61, adapter flange DN 100/DN 150
1 Adapter flange
2 Seal

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